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COMPREHENSIVE LAND USE INVENTORY

PROCEDURES MANUAL

FOR

DATA COLLECTION AND ANALYSIS

COMMONWEALTH OF MASSACHUSETTS

BOSTON REGIONAL PLANNING PROJECT

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PROCEDURES MANUAL

for the

1963 LAND USE INVENTORY

for the

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COMMONWEALTH OF MASSACHUSETTS

BOSTON REGIONAL PLANNING PROJECT

80 Broad Street
Boston, Massachusetts

by

VOGT, IVERS & ASSOCIATES
Cincinnati, Ohio
San Antonio, Texas
February 1966

THE BOSTON REGIONAL PLANNING PROJECT

80 Broad Street
Boston, Massachusetts

The Boston Regional Planning Project is a joint undertaking of the Department of Commerce and Development and the Massachusetts Department of Public Works in cooperation with the Urban Renewal Administration of the Housing and Home Finance Agency and the U. S Department of Commerce, Bureau of Public Roads.

Preparation of this report was financially aided through a Federal grant from the Urban Renewal Administration of the Housing and Home Finance Agency under the Urban Planning Assistance Program authorized by Section 701 of the Housing Act of 1954, as amended, and through Highway Planning and Research funds made available by the U. S. Department of Commerce, Bureau of Public Roads.

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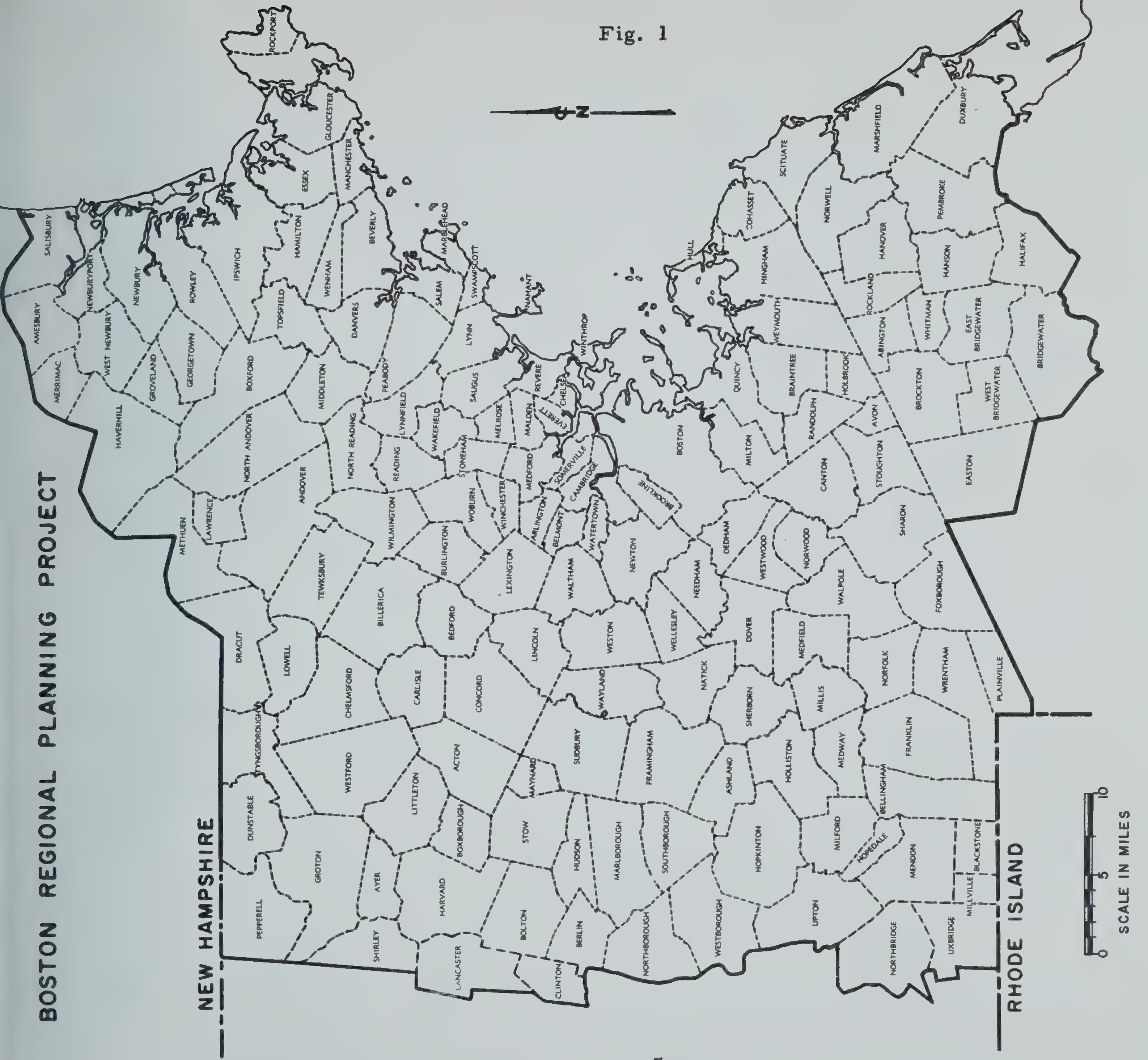
Fig. 1



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MASSACHUSETTS DEPARTMENT OF COMMERCE AND DEVELOPMENT
In cooperation with the
Urban Renewal Administration of the Housing and Home Finance Agency
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SECTION I

INTRODUCTION TO THE COMPREHENSIVE LAND USE INVENTORY

This manual has been written to provide the Boston Regional Planning Project personnel and other interested persons with a general understanding of the methods and procedures used in conducting the land use inventory for the Boston Regional Planning Project. The manual indicates methods and procedures followed in each phase of the inventory regarding the collecting, recording, storing and analyzing of data so that they may be used for multi-purposes by many agencies. For those who are to use the data recorded the manual is intended to give a basic understanding of what the data represent, how and where they are recorded and how they can be analyzed, presented and used to assist in making decisions for the development of a preliminary comprehensive development plan and program for the Boston Region.

The manual served as a guide to the staff assigned to various phases of the land use inventory. The manual established complete procedures in logical sequence for each phase so that proper training, supervision and control would be applied in field and office operations throughout the inventory.

The primary objective of the Boston Regional Planning Project is to develop a preliminary comprehensive regional plan and development program that emphasizes the region's transportation needs. A comprehensive transportation plan must be closely related to land use, population and economic patterns. The comprehensive land use inventory presents collected, summarized and analyzed data adaptable to transportation studies. The Procedures Manual states how the land use inventory data were collected, summarized, and analyzed. Tabulated results, example printouts, and computer programming requirements are discussed in detail in the Final Report and Data Processing Manual.

SECTION II

LAND USE DATA COLLECTION

A. Aerial Photography. An economical and effective method of collecting land use data is with aerial photographs. It was essential that the photographs reflect existing conditions. An aerial photographic survey of the Boston Region was undertaken. The aerial vertical photographs provided the main source for the land use inventory, base maps and land use analyses. Three photographic missions were flown during the Spring of 1963 at negative scales 1"=750', 1"=1500', and 1"=4800'. A total of 5711 exposures were made. Each original exposure has a 9" x 9" format. All flight lines were oriented in a north-south direction commencing on the western edge of the project area. (See Figure 2.) Each flight line of the medium altitude photography was flown with an 80% forward overlap between individual photographs and 22% side overlap. Photo numbers were sequentially numbered and automatically recorded for each film roll. Then a complete set of contact prints (9" x 9") was assembled and stapled to produce a properly labeled photographic index.

1. Base Maps.

a. Objective. The objective of the base mapping procedure was to prepare a series of base maps for the entire Boston Regional Project area at the standard scale of 1:24,000

BOSTON REGIONAL PLANNING PROJECT

TYPICAL FLIGHT MAP

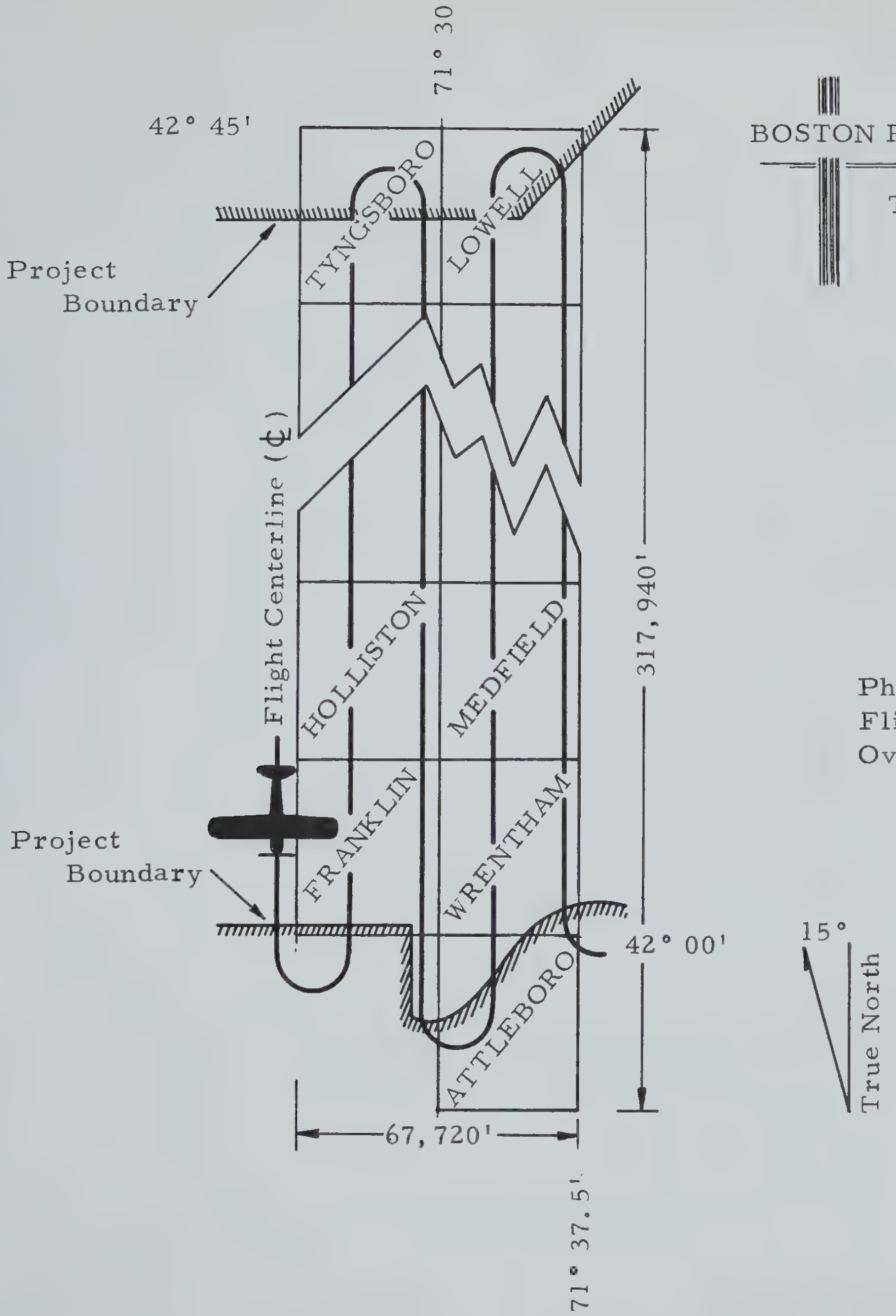


Photo negative scale 1" = 1,500'
Flight ℄ Distance = 10,530'
Overlap: Forward = 80%
Side = 22%

Fig. 2

(comparable to USGS quadrangle sheets), at a Section scale of 1:60,000 (covering four USGS quadrangle sheets), and at a Regional scale of 1:60,000 (consisting of two large sheets).

b. Method of Approach. A total of 65 sheets of USGS topographic quadrangle maps of 7-1/2' series at a scale of 1:24,000 cover the Boston Region. These were used as bases for the Standard Base Maps.

The planning area boundary lines were transferred to the USGS sheets. A sample portion of one sheet was drafted in its entirety and forwarded to the Boston Regional Planning Project staff for approval. Full scale drafting effort began upon receipt of the staff's approval.

Each USGS quadrangle sheet was overlain by a stable-base material, Cronaflex (DuPont type UC-4 drafting film). Each Cronaflex base overlay contained a legend, scale and pertinent credit phrasing as required in the contract.

Drafting proceeded with the inking of all hydrographic features, grid ticks and boundary information upon the Cronaflex base.

Planimetric updating progressed independently of and concurrently with the drafting of the aforementioned features. Aerial photography at a scale of 1 inch = 4,800 feet flown specifically for the purpose, was used during the course of the updating. The photographs were projected on a rectifying table of a Saltzman Reflecting Projector to plastic overlays bearing registration marks compatible with the USGS quadrangle sheets. Updated planimetric revisions were then annotated upon the overlays. Each of the 65 sheets within the planning area was individually inspected and revised where necessary. All required field checking was conducted during the period.

Each updated sheet was overlain by the Cronaflex base for the final inking phase. Completed sheets were edited and corrected where necessary. A set of clear acetate overlays was photographically prepared from the Cronaflex originals.

The Cronaflex bases were photographically reduced for later use in the construction of the Regional Base Map at a scale of 1 inch = 5,000 feet (1:60,000). These reduced scale base maps were compiled in units of four. Cronaflex and clear acetate copies of each map were prepared for transmittal to the Boston Regional Planning Project office.

c. The base maps include the following features:

(1) Planimetric Features

(a) Highways

Limited access (interstate, federal and state)

Federal and/or State

(b) Extensions of highways currently under construction

(c) Streets

    - (d) Unimproved dirt roads
    - (e) Railroads (named)
    - (f) Airports (named)
    - (g) Harbor facilities (exclusive of building)
    - (h) Canals (major ones named)
    - (i) Reservoirs (major ones named)
    - (j) Dams (major ones named)
    - (k) Major pipelines (as appearing on USGS sheets, and amended as required)
    - (l) Major power transmission lines (as appearing on USGS sheets, and amended as required)
- (2) Hydrographic Features (major ones named)
    - (a) Rivers and streams (as appearing in blue on USGS sheets)
    - (b) Swamps
    - (c) Marshes
    - (d) Lakes and Ponds
- (3) Positional Information
    - (a) Grid ticks at 10,000 foot intervals (Massachusetts Coordinate System)

        - (b) Grid ticks at 1,000 foot intervals
        - (c) Coordinate values at 10,000 foot intervals (Massachusetts Coordinate System)
        - (d) Coordinate values at 5,000 foot intervals (Data Summary Area System)
    - (4) Boundary Information
        - (a) State boundary lines
        - (b) County boundary lines
        - (c) Municipal boundary lines (city and town)
        - (d) Planning area boundary lines

2. Land Use Inventory Photography

a. Photo Enlargements. The land use data codes were recorded on the aerial photography where the physical feature images were evident. This procedure required enlargements to be made from the aerial photography. Two enlargement scales were selected to provide sufficient detail for land use coding. In the sparsely populated areas, principally in the western and extreme northern and southern portion of the Boston Region, photo enlargements were made to a rural scale of 1 inch = 300 feet. In the more populated areas, particularly inside Route 128, the photo enlargements were provided for an urban scale of 1 inch = 150 feet. A total of 559 photo enlargements were made for the rural areas and 800 photo enlargements were made for the urban areas. All enlargements were produced on double-weight photographic paper with semi-matte finish. Following the extensive use during the land use inventory the enlargements were repaired by paper-backing and tape-edging. The surfaces were sprayed with a clear plastic spray. The enlargements were then placed in two filing cabinets and recorded by geographic coordinates.

The enlargements were made without control establishment, but ratio matching was utilized such that certain images were selected and matched to the corresponding detail on the USGS quadrangle sheets. The scale between these points was established through proper rectification in the process of producing the enlargements. In relation to the scale of enlargement (either 1'' = 300' or 1'' = 150') and the particular area of the negative used (regarding the photographic nadir point), the dependability of the enlargement to maintain a valid horizontal measurement decreased. Thus, the photo enlargements should not be considered as photo maps. Grid lines indicated on the photo enlargement overlays meet acceptable limits of accuracy when compared to photo images and corresponding detail on the USGS quadrangle sheets.

b. Photomosaics. A series of 65 photomosaics were constructed at a scale of 1 inch = 2,000 feet (1:24,000). Each mosaic sheet in the series corresponds in name and size to the base maps and to the USGS topographic quadrangle sheets. The mosaics were prepared on stable-base Cronar material suitable for reproduction. Each mosaic contains that information that was inherent in the original photography from which it was constructed, plus the names of key cities for easier identification. In the margin adjacent to the image area grid and coordinate information are scales, legend and names. The photomosaics present a current pictorial representation of the area covered but were not constructed to standard map accuracies.

c. Vertical Aerial Photographs 1:18,000 (1963). Aerial photographs were taken at a photo negative scale of 1 inch = 1,500 feet and provided full stereoscopic coverage. Each photograph covers an area of about 6-1/4 square miles (2-1/2 by 2-1/2 miles). These photographs were used as a prime data source for the historic land development and vacant land analysis.

3. Land Use Analyses.

a. Vacant Land Analysis. The photomosaics, base maps and contact prints were utilized in the Vacant Land Analysis (see page 56).

b. Historic Land Development. A complete set of contact prints and indices covering the Boston Region were obtained from the U. S. Department of Agriculture. The photography was taken in 1952 at a scale of 1:20,000. These prints were compared with contact prints from the 1963 photography (scale 1:18,000) in determining land use development changes (see page 56).

B. Land Use Coding System. Land use analysis can be no better than the classification system it is based upon. Comprehensiveness and flexibility are the criteria which contribute most toward an adequate land use classification system. Comprehensiveness implies a classification system designed to include coded identification of all activity taking place on the land. Flexibility can be provided through a uniform land use classification system designed to exploit the utility of electronic data processing equipment and coded to closely conform with the Bureau of Public Roads land use classification and with the Standard Industrial Classification economic categories. Use of a modified SIC system for land use categories provides coordination of land use data with federal employment and economic statistics. For direct comparison of codes and classifications of the Boston Regional Planning Project land use categories with the Bureau of Public Roads and the Standard Industrial Classification system, refer to Appendix C.

1. Objective. The objective of assigning code values to various types of land uses is to provide a classification listing which indicated how the land was being utilized at the time of the survey.

Studies will be performed in the future by analysts for land use planning, transportation studies, population studies, etc. Certain criteria were established which regulated the kinds and numbers of categories of land uses which were used in the land use survey. These criteria were:

a. The number of categories was limited in order not to increase unduly the cost of collection and to make analysis rapid and economical.

b. Land use categories were defined so that the trip generating characteristics within each major land use group are generally uniform.

c. The categories defined enable the land uses to be used in conjunction with economic forecasts and to aid in the forecasting of land use requirements. The categories are compatible with economic classifications used in the Standard Industrial Classification Manual.

d. The categories are also compatible with classifications normally used in regional planning and transportation studies.

The basic objective of the land use inventory is to classify into 63 categories and to measure accurately the use and areal extent of all land in the Boston Regional Planning Project area.

To simplify collection of land use data in the Boston Regional Planning Project, the region has been divided into two parts: rural and urban. Each part was inventoried using a specific method. For land use data collection in the rural western areas of the Boston Regional Planning

Project, aerial photographs were used as the primary data source. In the rural western areas a small percentage of land uses could not be readily identified by photo interpretation. When this situation occurred a field check was undertaken. In the urban areas, particularly Boston and the surrounding cities within Route 128, data was collected by field data collection teams. Aerial photographs were used for control purposes and for orientation.

The inventory of current land use information was gathered from two basic sources: current aerial photos and field survey. Aerial photographs were taken at a scale of 1:18,000 (1" = 1500'). These aerial photographs formed one basic source document for the land use inventory. Enlarged photographs at scales of 1" = 150', and 1" = 300' were used to measure the actual areal extent of all land use identified by photo interpretation and field surveys.

Complete records were kept by all supervisors and group leaders on all phases of the inventory including notes on all decisions made with respect to coding, and other aspects of the study. Records were kept on the number of base maps, aerial photographs, amount of work done by all photo interpreters, field data recorders and office data coders, transmission of forms between various survey operations, transmission of forms to be keypunched, etc. Such controls are essential to prevent loss of data and records.

2. Basic Land Use Coding System. The basic system of land use identification was a

combination of the Bureau of Public Roads land use classification and the Standard Industrial Classification, modified to be compatible with the types of land uses normally considered in regional planning and transportation study work. The classification used, groups land according to the activity occurring on it, in eleven major categories made up of sixty-three minor categories, using a two digit numbering system. Major land use categories are as follows:

a. 00 Residential (7 minor)

b. 10 Durable Manufacturing (4 minor)

c. 20 Non-Durable Manufacturing (7 minor)

d. 30 Transportation Communication, Public Utilities, Quarries (8 minor)

e. 40 Retail Establishments (9 minor)

f. 50 Wholesaling, Warehousing, Storage (3 minor)

g. 60 Services: Personal, Office, Finance (6 minor)

h. 70 Public, Quasi-Public Buildings (9 minor)

i. 80 Public Open Space, Outdoor Recreation (3 minor)

j. 90 Vacant Land: Agriculture, Forest, Water (6 minor)

k. 99 Roads (1 only)

See Appendix for detailed numerical and alphabetical Land Use Code Listing.

C. Coding of Land Use on Aerial Photo Enlargements.

1. Objective. The aerial photographic interpretation part of the land use inventory had one basic objective: to identify and interpret those features which compose the elements of a comprehensive land use inventory. All land uses were identified using photo interpretation augmented by field survey. A photograph maintains a dated record of the existing land use elements. From a map source comparison (for scaling purposes) the data contained on the photo was put to wide use. Photo interpretation of individual photos and comparison by direct viewing of two or more photos was utilized extensively in the historical land use study (page 56), vacant land analysis (page 56), and land use coding for the current land use study described below.

2. Office Photo Interpretation Land Use Coding. A group leader assigned an enlargement with completed geographic grid coding, to an office data coder. The date of issue and the name of the data coder were recorded in the control block on the aerial photo enlargement. A record was maintained by the Chief Photo Interpretation Supervisor. The photo interpretation of the land use inventory for the Boston Region dealt primarily with rural uses: agriculture, forest, park, lakes, etc. These areas yield advantageously to office land use coding. Typical uses to be found in rural areas which are recognizable on aerial photographs are:

Houses, drive-in theatres, race tracks, churches, schools, service stations, motels, trailer courts, rest homes, hospitals, sand and gravel pits, quarries, cement plants, dumps, lumber yards, saw mills, transportation facilities and railroads, power facilities and military installations.

These types of land uses were identified on aerial photos at a scale of 1" = 300'.

Individual land uses were identified and delineated according to "measurement areas." A "measurement area" is defined as any contiguous land use designated by one land use code and not split by any census tract, municipality, traffic zone and subzone, or DSA boundary. An orange colored line was used to delineate the land use measurement area boundary and its code number was indicated in red pencil on the photo enlargement.

Each land use was identified and recorded by use of a two digit code which was placed near the center of the land use area. Extreme care was taken to see that the codes were correctly recorded and that the pencil numbers were clear and easy to read.

Land use categories, listings given in numerical order and in alphabetical order (see Appendix) were used as a guide for coding land use data. The following steps were taken for coding purposes:

a. Extensive ("Public and Quasi-Public") land use holdings. Before the smaller detailed land uses were identified on the aerial photo enlargements, extensive land use areas were first delineated. These major land uses include:

> municipal, state and national parks, airports, major institutions, colleges, military installations and other major land holdings.

b. The second step was to identify and record extensive rural uses, including; forest, scrubland, agricultural, swamp, lakes.

c. Smaller detailed land uses were also identified using the aerial photos. After extensive land uses were identified, systematically, each smaller area land use was identified and marked with its proper land use code.

d. Unidentified land uses. Land uses not readily discernible from the aerial photographs were marked. These land uses were then investigated and coded by data coders.

When a photo was completed by the photo interpreter, he signed his name in the appropriate control space on the aerial photo and returned it to his group leader for review.

3. Field Survey Land Use Coding. The field data collection part of the land use inventory had one basic objective: to identify land uses in those sections of the Boston Regional Planning Project survey area which were not discernible from aerial photographs. There were two types of areas where field data collection was necessary:

a. Intensively urbanized areas where the land and building uses could not be completely identified from aerial photographs (coding stores with apartments above, etc.)

b. Sparsely settled or developed areas where a few land and building uses could not be completely identified from aerial photographs.

Before field data collection began, the Field Supervisor determined the general method to be used in field data collection. This decision was made utilizing aerial photographs to estimate the required amount of detailed coding. The methods used in field coding of land use data are as follows:

a. Coding of areas where field survey utilized automobiles:

A team of two persons in an automobile could code land use areas efficiently. This procedure was utilized in relatively sparsely developed or populated areas.

b. Coding of areas where field survey was by foot:

To provide detailed coding of proper land uses in densely congested areas, extensive field coding was accomplished by walking "door to door" and coding, Areas so coded pertained to high density residential, commercial and industrial centers, multi-storied structures, and multiple dwellings.

Supervisory personnel, group leaders and all field data collectors participated in a test of procedures in recording land use data on the aerial photographs and subsequent processing of data input forms so that they fully understood the survey objectives and the nature of field problems. The following procedures were utilized:

The field data coder received an assigned area for which coded data was necessary. He was also given an aerial enlargement covering the assigned area. Instructions were given to either drive or walk the area. The area was then coded on the photo enlargement by "on-site" inspection.

The objective of the field survey was to identify and delineate the required predominant use of all land and buildings according to measurement area.

Land use categories, given in numerical order and in alphabetical order, (see Appendix), were used as a guide for coding land use data. The field data coder learned the different types of land uses which needed to be distinguished one from another. A list of these land use categories and their land use codes in numerical and alphabetical order was taken into the field by each coder. These land use categories provided background material which helped the field coder accomplish accurate coding.

It was important that the field data coder indicated the type of land use by code and the extent of the land use taking place in each building or land area. Legible recording of data was essential.

Where there was more than one use in a building, the field coder determined the predominant type of activity. This was defined as the predominant use of the building in floor area. If it appeared that the building was used equally by two different categories, such as: department store on the ground floor with apartment units above of equal area, the dominant use was assigned by the following priorities:

(1) Retail Establishments

(2) Services

(3) Manufacturing

(4) Transportation

(5) Public or Quasi-Public

(6) Wholesale or Storage

(7) Residential

If there were four or five stories in a single building, each having about the same floor area and each floor having a separate use, the general category of land use (e.g., a retail use) was chosen as the dominant use according to the above list. If a building appeared to be divided by a fire or party wall so that two measurement areas could be readily distinguished on the photo the building was coded as two uses if each part of the building had a separate use. Special care was taken when mixed retail, service and residential uses were encountered.

Private residential garages, barns and sheds were not considered as land uses. Where a private garage, barn or shed was noted, an "X" was placed on the roof of its photo image. A public parking garage and repair garage were both considered as buildings. There were many measurement areas which had no building thereon; a vacant lot and parking lot are examples.

Wherever residential uses were encountered (even where they did not form the dominant use) the number of dwelling units were recorded on the aerial photo immediately under the land use code, in the following way: 01/1 for single family; 02/2 for two family; 03/27 for a 27 unit apartment; 44/6 for six apartment units over a department store. The field coder determined the number of dwelling units in each building.

If there was a trailer (on the aerial photo) in addition to a residential building on a lot, the trailer was counted as one dwelling unit. A trailer park or trailer court, defined as three or more trailers in use was coded 08. If there was no building on the lot it was coded vacant 92.

Wherever residential construction projects were encountered, the number of future dwelling units (houses or apartments) were counted or estimated, and recorded on the aerial photo immediately under the land use code. For example: 97 land use code, a construction project with 54 houses (or apartments) under construction was coded 97/54.

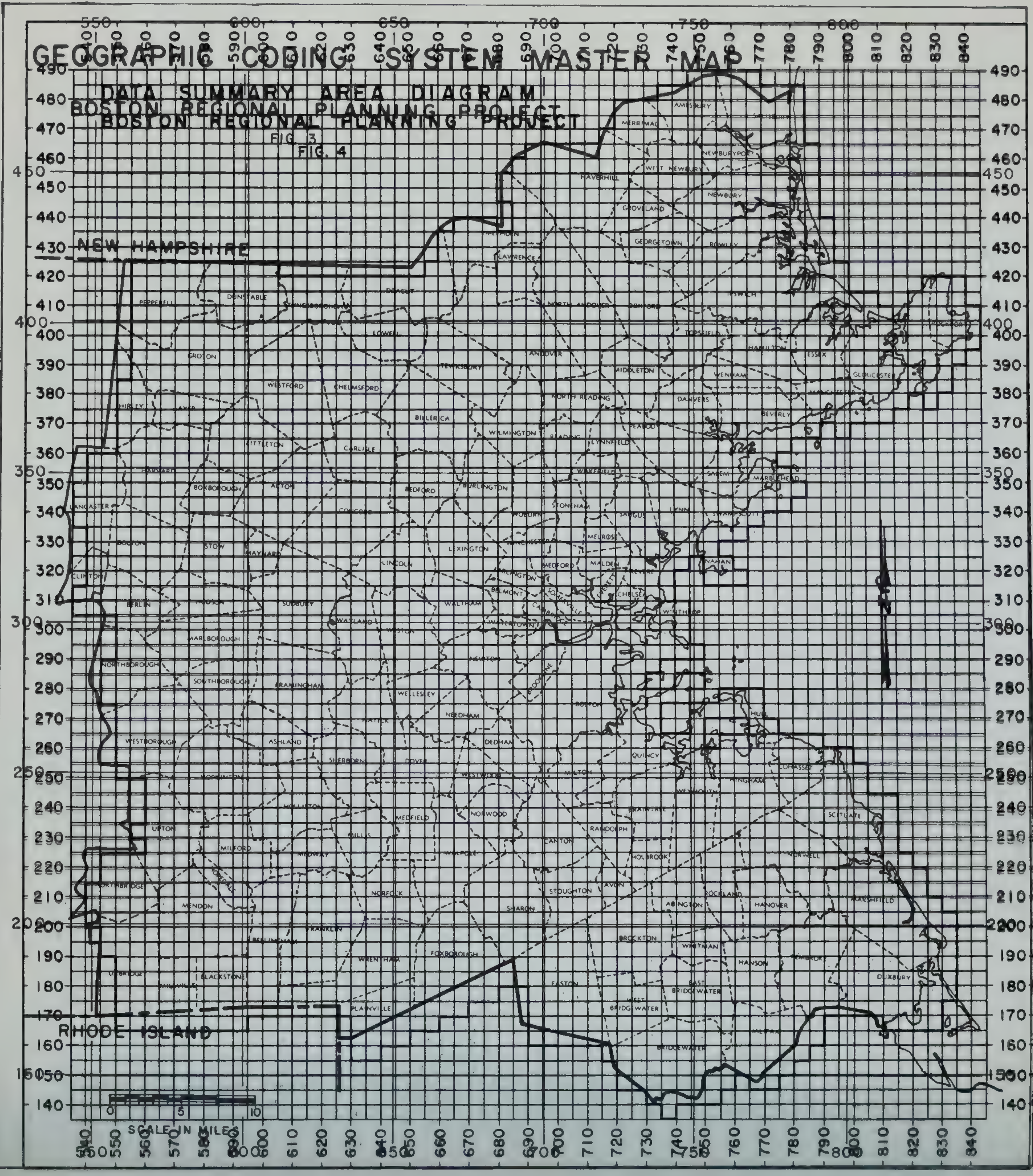
After the field data collection was completed and coordinated with office photo interpretative procedures to complete the land use coding on aerial photographs, the phase of land use measurement and recording was undertaken.

GEOGRAPHIC CODING SYSTEM MASTER MAP

DATA SUMMARY AREA DIAGRAM
BOSTON REGIONAL PLANNING PROJECT
BOSTON REGIONAL PLANNING PROJECT

FIG. 3

FIG. 4



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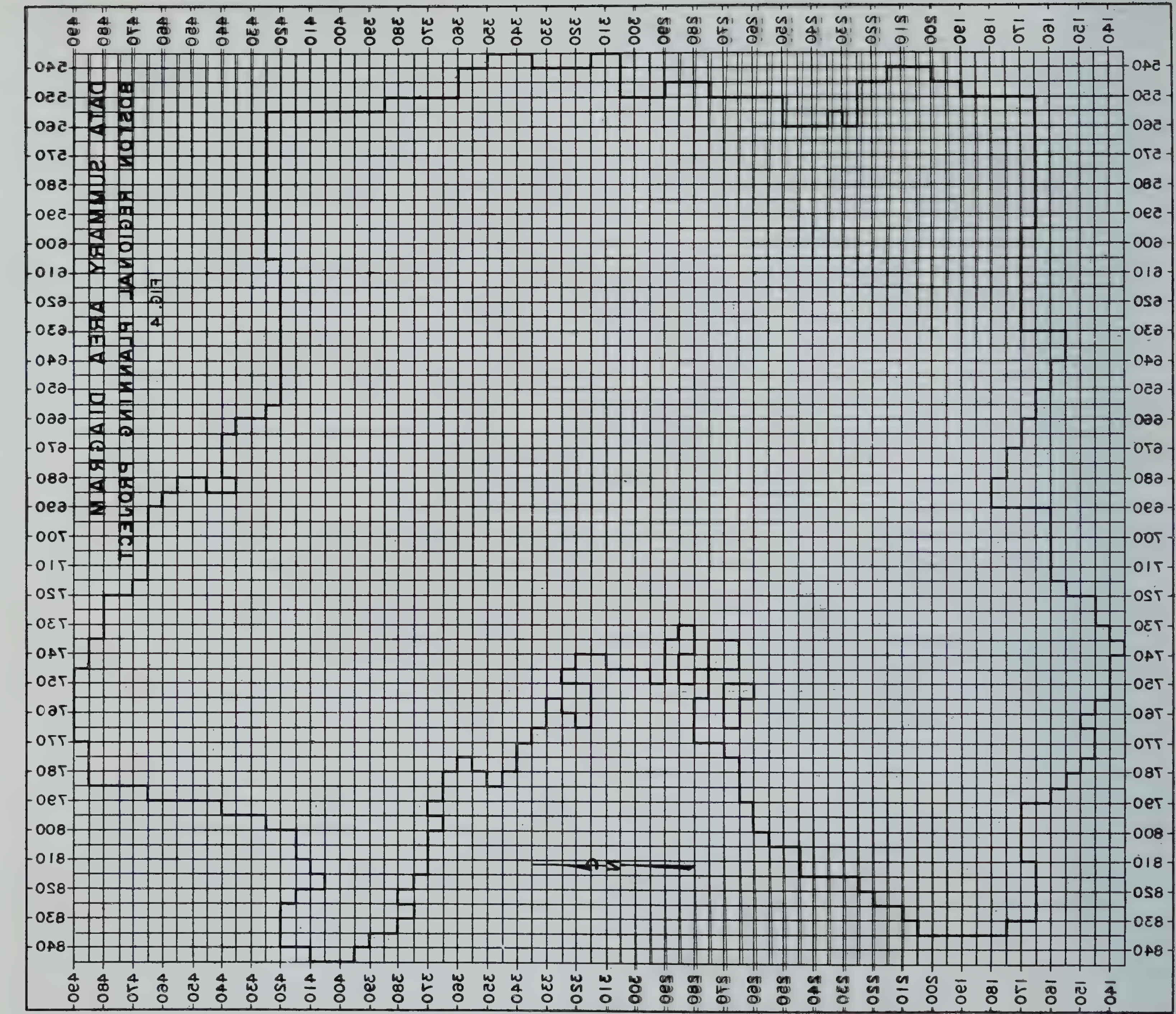
In cooperation with the
Urban Renewal Administration of the Housing and Home Finance Agency

The preparation of this map was financially aided through a Federal grant from the Urban Renewal Administration of the Housing and Home Finance Agency under



DATA SUMMARY AREA DIAGRAM

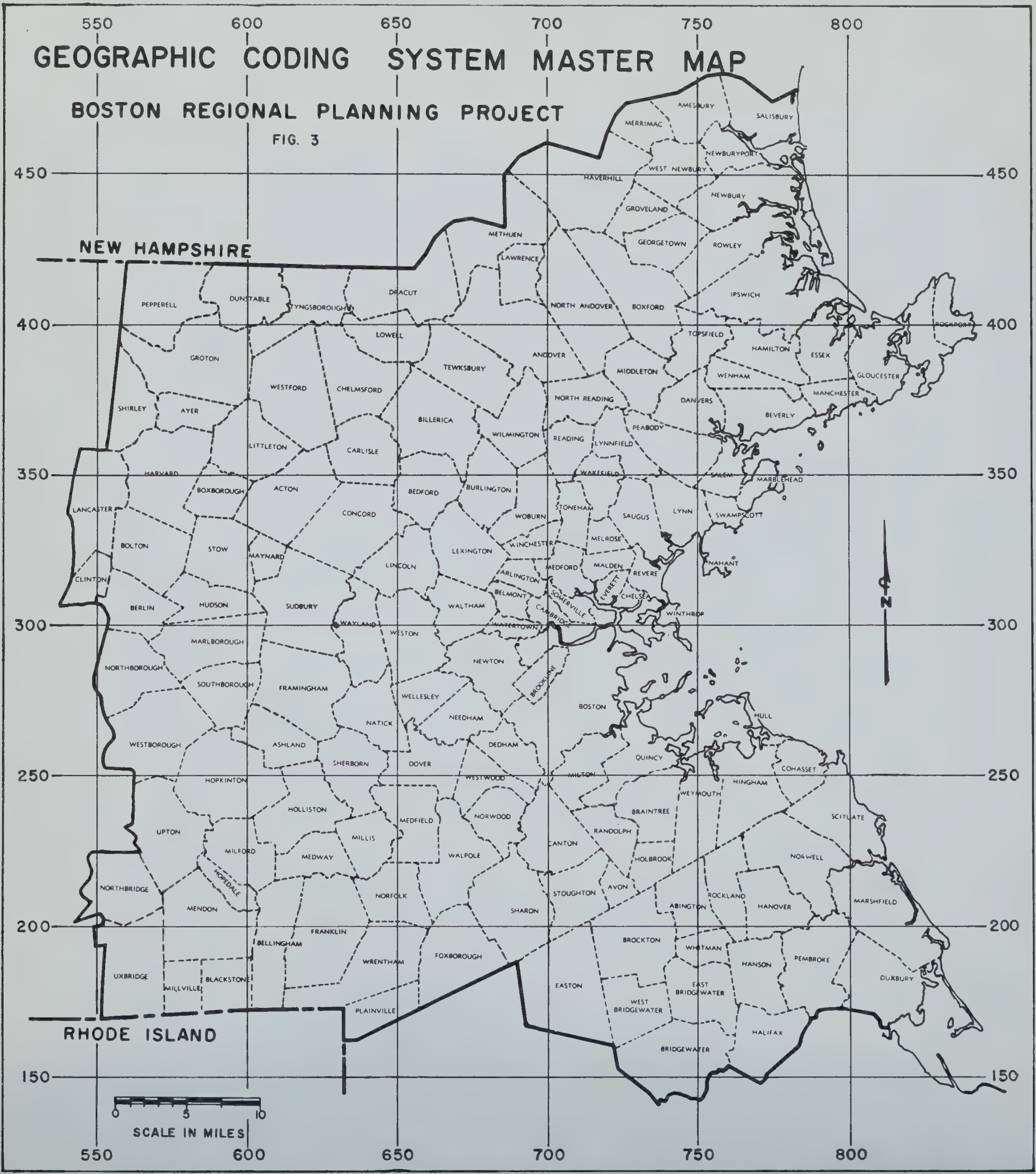
BOSTON REGIONAL PLANNING PROJECT

FIG. 4

GEOGRAPHIC CODING SYSTEM MASTER MAP

BOSTON REGIONAL PLANNING PROJECT

FIG. 3



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SECTION III

SUMMARIZATION OF DATA

A. Geographic Coding System. All land and water within the approximately 2400 square miles comprising the Boston Regional Planning Project Study Area was coded to a series of geographical and political units. The coding procedure used had the objective of providing unique geographic identification for each measurement area within the region. Using the procedures defined herein each measurement area was located by the geographic coordinates which define its boundary and by the Data Summary area, Municipality, Census Tract and Traffic Zone of which it is a part.

Other procedures could have been used but none permit the flexibility for updating, multiple criteria summaries, and plotting as are inherent in the procedure used.

To accomplish this procedure required that all land use measurement areas be coded to a grid coordinate system (see Figures 3 and 4) which permit the data to be reorganized into any number of alternate forms as might be required to satisfy specific requirements of a particular area, study or analysis. The basic coordinate system selected for use is an adoption of the Massachusetts Coordinate System, Mainland Zone.

The Massachusetts Coordinate System is the system of plane rectangular coordinates established by the United States Coast and Geodetic Survey for the Commonwealth of Massachusetts. The Boston Region is in the Mainland Zone. The methods for establishing the grid coordinates within this system are established by the general laws of the Commonwealth as follows:

Chapter 47 Acts of 1941

Section 10. The plane rectangular coordinates of a point on the earth's surface, to be used in expressing the position or location of such point in the appropriate zone of said system, shall consist of two distances, expressed in feet and decimals of a foot. One of these distances, to be known as the "X-coordinate," shall give the position in an east-west direction; the other to be known as the "Y-coordinate," shall give the position in a north-south direction. Such coordinates shall be referred to the appropriate origin as defined in section eleven, and shall be made to depend upon and conform to the plane rectangular coordinates of the triangulation and traverse stations of the United States Coast and Geodetic Survey within the Commonwealth, as these coordinates have been determined by said survey.

Section 11. For the purpose of more precisely defining said system, the following definition by the United States Coast and Geodetic Survey is hereby adopted:

The Massachusetts Coordinate System, Mainland Zone, consists of a Lambert conformal projection of the Clarke spheroid of eighteen hundred and sixty-six, having the standard parallels at north latitudes forty-one degrees forty-three minutes and forty-two degrees forty-one minutes, along which parallels the scale shall be exact. The origin of coordinates for this zone is at the intersection of the meridian seventy-one degrees thirty minutes west longitude and the parallel forty-one degrees no minutes north latitude. This origin is given the coordinates:

X = 600,000 feet: Y = 0 feet

The grid coordinate numbering system of the Massachusetts Coordinate System has been adjusted by the Boston Regional Planning Project. The "X" coordinate numbers used correspond exactly to the Massachusetts mainland zone numbers (less 000). The "Y" coordinate numbers used are always 200 less than the corresponding Massachusetts mainland zone numbers (less 000). By modifying the "Y" values possible confusion between "X" and "Y" coordinate numbers within the Boston Region has been eliminated. For example, the original Massachusetts mainland zone numbers X 655,000, Y 565,000, have been re-numbered in the Boston Region to X 655, Y 365. The X coordinate values for the Boston Region range from X 535 to X 850, while the Y coordinate numbers fall between Y 135 and Y 490. The origin point as stated by the General Laws of the Commonwealth quoted above thus equates to the Boston Region adjustment as:

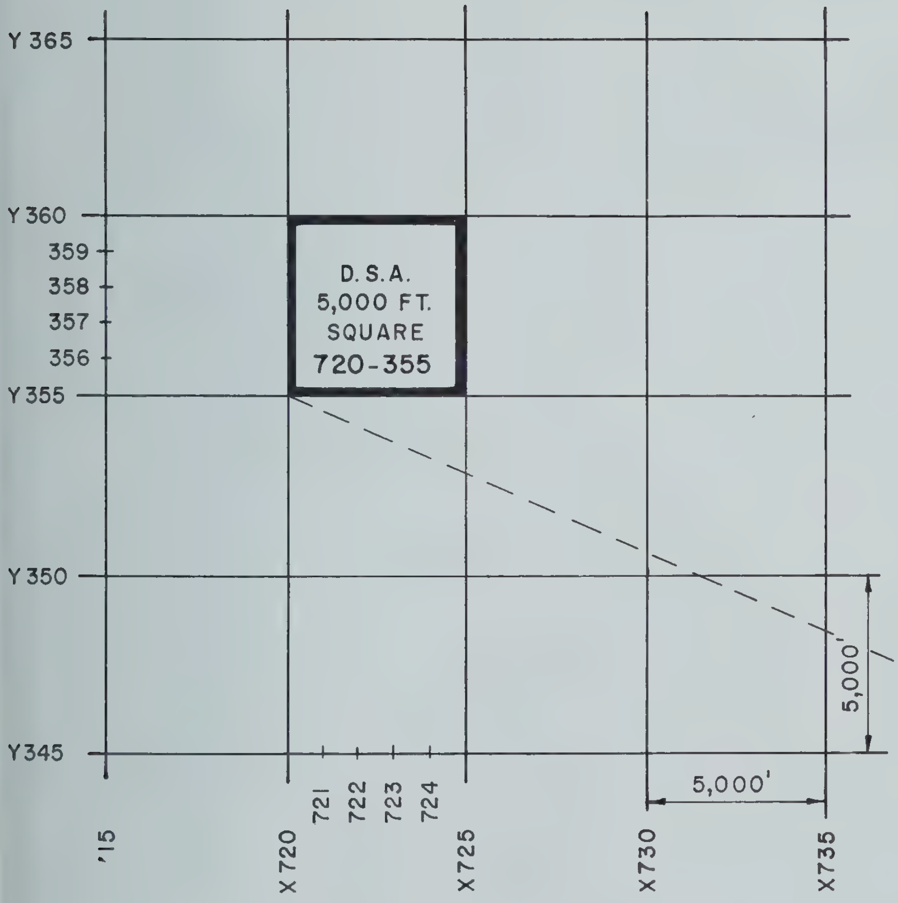
71°30' = 600,000 (Massachusetts Coordinate System, Mainland Zone)
41°00' = 0 = -200

Example:	X	Y
Massachusetts	655,000	565,000
Step 1	655	565
Step 2	-0	-200
B. R. P. P.	655	365

Data Summary Areas. The grid coordinate system was drawn to overlay a complete set of USGS maps of eastern Massachusetts, at a scale of 1" = 2000', with lines at 1,000 feet intervals north-south and east-west. Every tenth line in each direction was made to coincide exactly with the Massachusetts 10,000 foot grid coordinate system, Mainland Zone.

DSA GRID SYSTEM

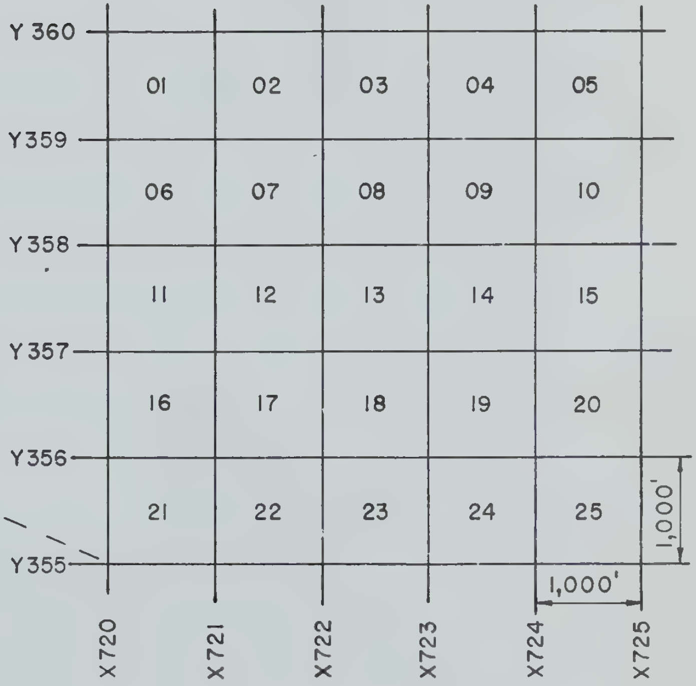
Fig. 5a



DSA SUB-AREA SYSTEM

720-355

Fig. 5b



See Fig. 4 for DSA Diagram

The 1,000 feet grid system was then labeled according to a six digit numbering code. The first three digits of the number describe the "X" position, from west to east across the Boston Regional Planning Project area; the last three digits describe the "Y" position, from south to north across the Region.

Thus, every part of the 2400 square miles comprising the Boston Regional Planning Project area has a unique six digit number which describes its geographic position in 1,000 feet increments within the Region.

Every fifth "X" coordinate and every fifth "Y" coordinate has been used to describe an area 5,000 feet square which is used as a "summary area" for data. These summary areas, each comprising 25,000,000 square feet, or 573.92 acres, are referred to as "data summary areas" or DSA's (see Fig. 5a).

Each DSA is sub-divided into twenty-five squares each being a "sub-area." The numerical sequence designating each sub-area commences in the upper left corner, book-read fashion so that the twenty-fifth sub-area is in the lower right corner (see Fig 5b). One sub-area describes an area 1,000 feet square or about 23 acres. No summarization by sub-area is intended but the purpose is to uniquely identify measurement point locations for programming efficiency.

The use of the DSA sub-areas requires some explanation. Every point (pair of coordinates) required to identify a boundary point for the measurement areas has a discrete identification in the region. This identification is by DSA number, sub-area number and point number. A maximum of 99 points may be included in each sub-area. Where the number of points required for a sub-area is more than 99 points the sub-area is quartered resulting in a maximum of 396 possible point numbers (see Fig. 5d). The method used to number minor sub-areas when dividing all 25 sub-areas in a DSA to establish the upper left quarter of the sub-area with the sub-area number and re-number the other three quarters. The re-numbering was accomplished for the upper right quarter according to the following formula: N = 23 + 3 (sub-area number)

Similarly the lower left quarter is numbered according to the formula N = 24 + 3 (sub-area number) while the lower right quarter is re-numbered according to the formula N = 25 + 3 (sub-area number) except that in sub-area 25 the lower right quarter is numbered 00 rather than 100. When only a portion of the sub-areas in a DSA are divided into four parts the upper left quarter is numbered as described above but the numbers for the other three quarters are selected from the available numbers in the sequence without regard to location. The grid lines and coordinate values were placed on the photo enlargements. Plastic type transparent overlays were prepared with grid lines and sub-area numbers pre-printed. The land use codes were transferred from the enlargements to the overlays (see Figs. 6a and 6b). Additionally,

URBAN DSA OVERLAY GRID WITH SUB-AREAS

I DSA PER OVERLAY

OVERLAY SCALE: 1" = 150'

Fig. 5c

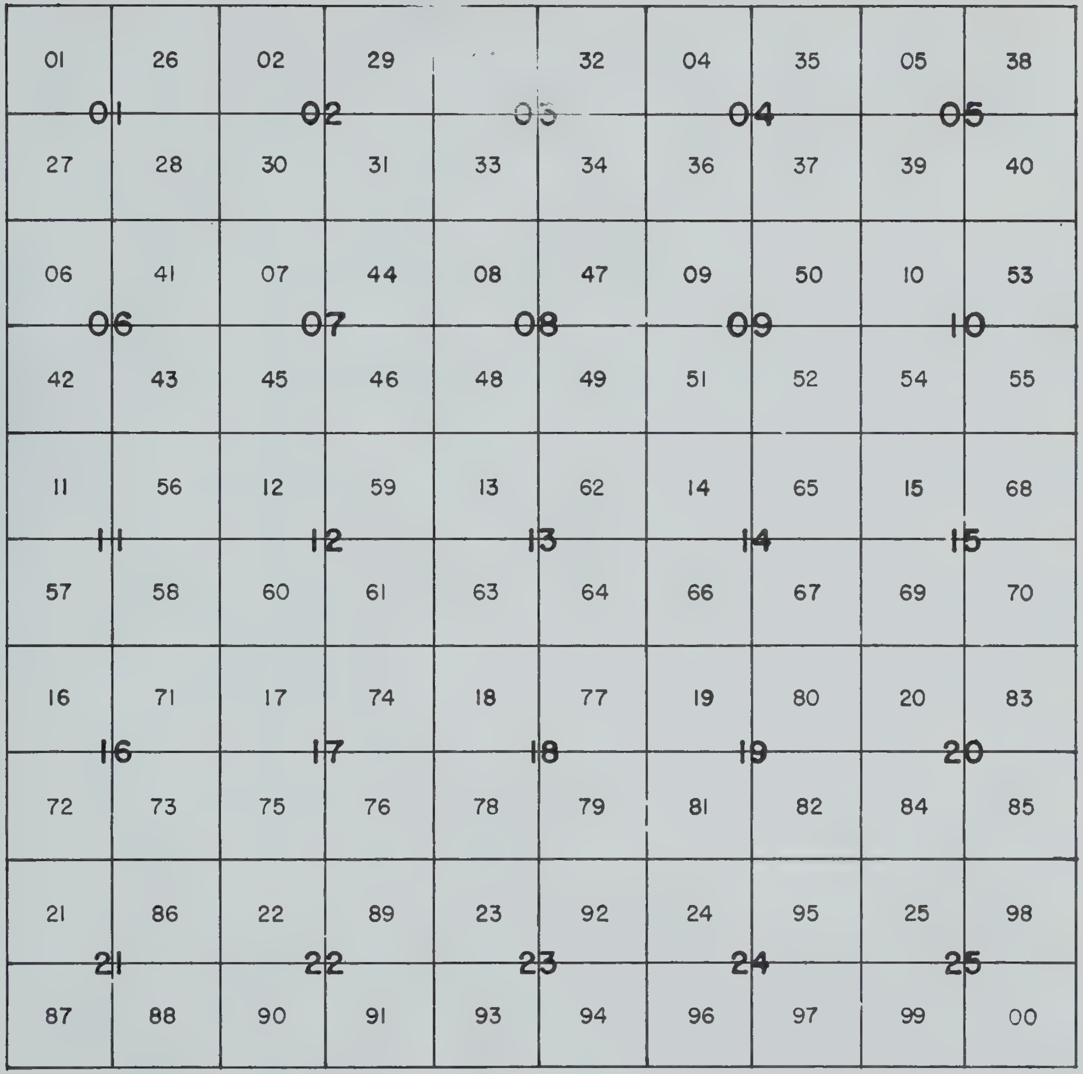
01	02	03	04	05
06	07	08	09	10
11	12	13	14	15
16	17	18	19	20
21	22	23	24	25

URBAN DSA OVERLAY GRID WITH SUB-AREAS AND MINOR SUB-AREAS

1 DSA PER OVERLAY

OVERLAY SCALE: 1" = 150'

Fig. 5d



01	26	02	29	[illegible]	32	04	35	05	38
27	28	30	31	33	34	36	37	39	40
06	41	07	44	08	47	09	50	10	53
42	43	45	46	48	49	51	52	54	55
11	56	12	59	13	62	14	65	15	68
57	58	60	61	63	64	66	67	69	70
16	71	17	74	18	77	19	80	20	83
72	73	75	76	78	79	81	82	84	85
21	86	22	89	23	92	24	95	25	98
87	88	90	91	93	94	96	97	99	00

RURAL DSA OVERLAY GRID WITH SUB-AREAS

4 DSAs PER OVERLAY

OVERLAY SCALE: 1" = 300'

Fig. 5e

01	02	03	04	05	01	02	03	04	05
06	07	08	09	10	06	07	08	09	10
11	12	13	14	15	11	12	13	14	15
16	17	18	19	20	16	17	18	19	20
21	22	23	24	25	21	22	23	24	25
01	02	03	04	05	01	02	03	04	05
06	07	08	09	10	06	07	08	09	10
11	12	13	14	15	11	12	13	14	15
16	17	18	19	20	16	17	18	19	20
21	22	23	24	25	21	22	23	24	25

the proper grid coordinate values were assigned in accordance with the enlargement. The overlays provided two basic functions. The proper municipality, census tract and traffic zone boundaries and numbers were established for each DSA. The consolidation of data sources and elimination of photographic images provided a desirable product for preparation of input data for electronic machinery.

Two types of overlays were prepared and are described as follows:

a. The urban DSA overlay was prepared at a scale of 1 inch = 150 feet. The overlay measured 33.33 inches square for the grid size. Control blocks for initialing work accomplished and for checking purposes were located at the bottom right corner (Fig. 6b). One DSA was represented on one urban overlay. Each sub-area measuring 6.67 inches square represented a scale distance of 1000 feet on a side corresponding to the Massachusetts coordinate system (see Figs. 5c and 5d).

b. The rural DSA overlay at a scale of 1 inch = 300 feet was the same physical size as the urban overlay (33.33 inches square). Control blocks were similarly located. However, due to the scale difference between the urban DSA and rural DSA, four DSA's were represented on one rural overlay (see Fig. 5e).

Correspondingly, the urban DSA overlays utilized photo enlargements prepared at the urban scale of 1 inch = 150 feet, and the rural DSA overlays utilized photo enlargements prepared at the rural scale of 1 inch = 300 feet.

B Measuring and Recording Part of the permanent records for the land use inventory are enlargements of the aerial photographs at scales of 1" = 300' and 1" = 150'. These enlargements served as a source document and as a basis for maintaining and checking survey data since the photos contain the only combined record of geographic identification and land use identification of all land within the Boston Region. Prior to identification of individual land uses, geographic identification of each data summary area was made for the 1" = 300' and 1" = 150' scale enlargements.

Transfer of Data from Photo Enlargements to Overlays. The "Overlay Procedure" presents the first step of transfer of data. The transfer of data is a systematic approach to accurate programming and computing for the land use study (see Figs. 6a and 6b).

Steps:

1. A proper scale overlay was temporarily attached to the enlargements; using a purple felt marker, the grid coordinate numbers were put on lower left corner of the overlay sheet and at each vertical grid at the top. Where applicable for rural DSA overlays the center point of the quadrant was located by an "X" coordinate value at the middle bottom and a "Y" coordinate value on the middle left side.

2 Using an orange felt marker with a solid boundary line, the traffic zone(s) was established from the traffic zone boundaries and number(s) provided as source material by the Boston Regional Planning Project.

3. Using a blue felt marker with a dashed boundary line, the census tract(s) was established from the quadrangle maps furnished as source material.

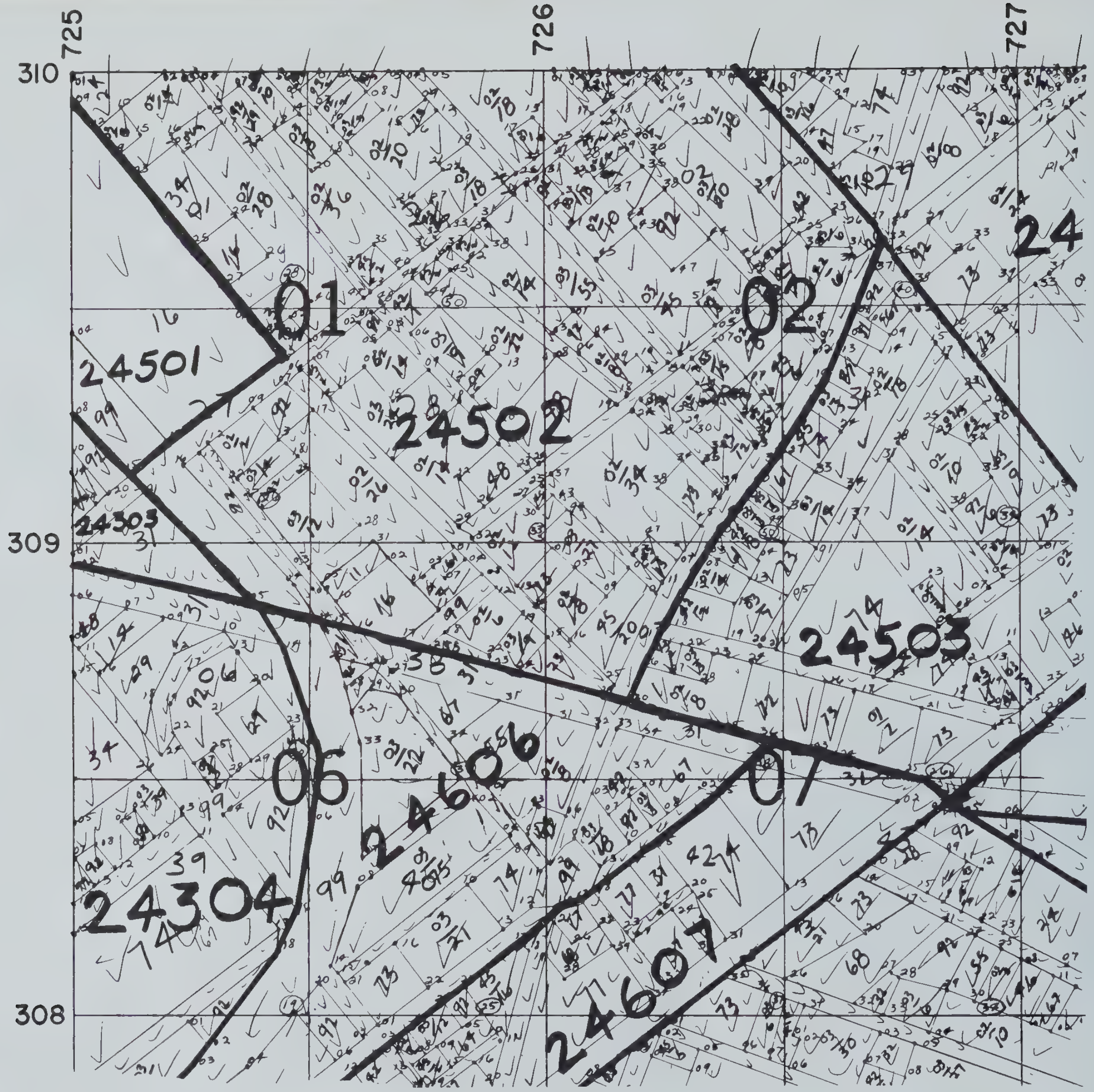
4. Using a green pencil, the "newly" developed areas (after 1952) were indicated by circling the land use code area or inserting a revised land use code and defining this area by green colored boundaries. (See page 56 for historic land development study).

5. Using a brown felt marker with an "X'ed" boundary line, the municipality was established from data on the USGS quadrangle maps and the municipalities list used as a reference source.

6. Reference was made to the correction documents provided by the Planning Project for possible corrections and/or additions.

7. Using a red lead pencil, the DSA corners were dot plotted, coincident with the exact grid corners.

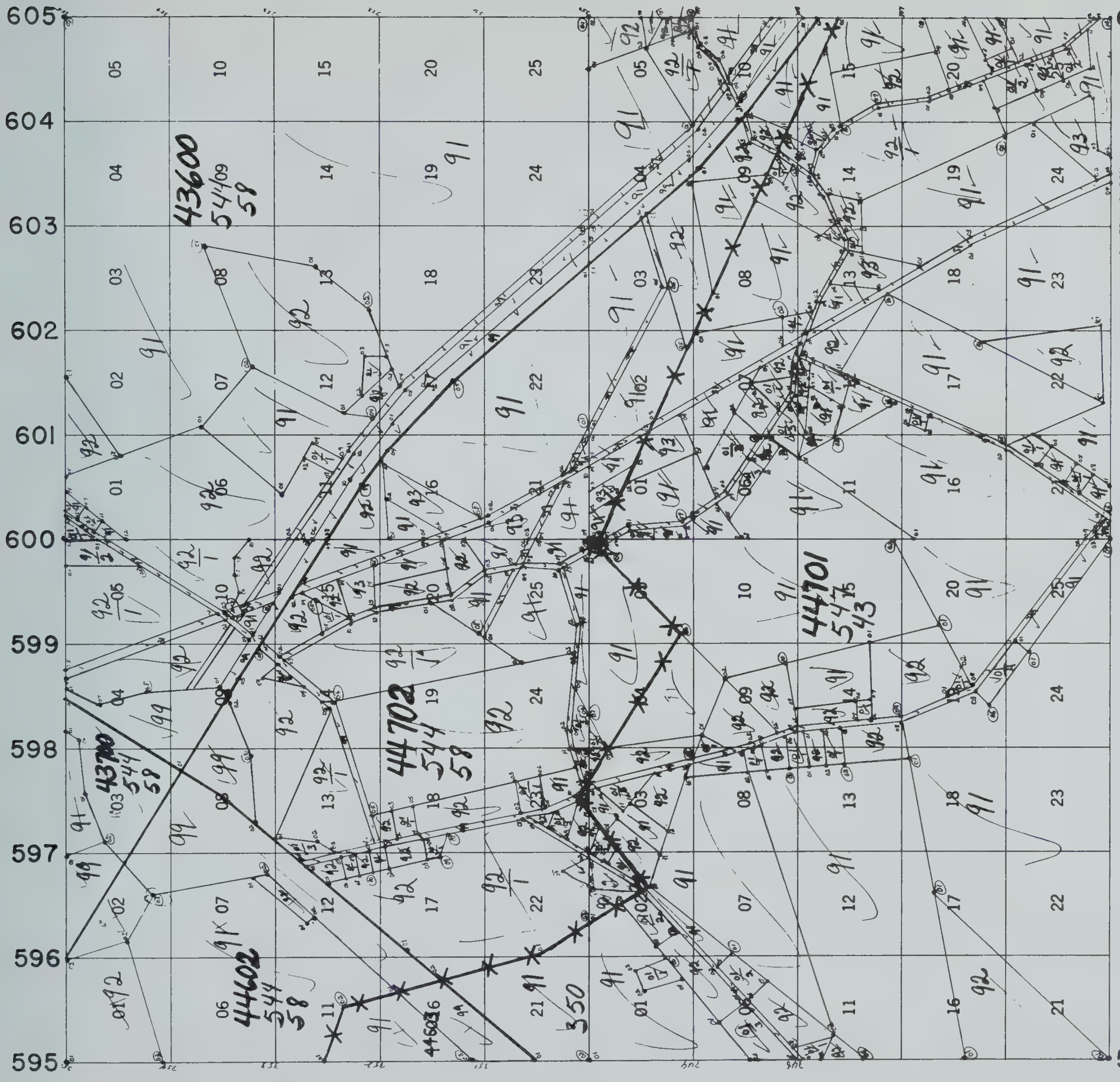
8. As a continuation from paragraph "7" above, each and all land use areas were described by dot plotting the measurement points.



PORTION OF URBAN DSA OVERLAY
WITH SUB-AREAS & MINOR SUB-AREAS
(SEE FIG. 5d FOR NUMBERING REFERENCE)

SCALE 1" = 333'

FIG. 6a



EXAMPLE OF RURAL DSA'S

SCALE 1" = 750'

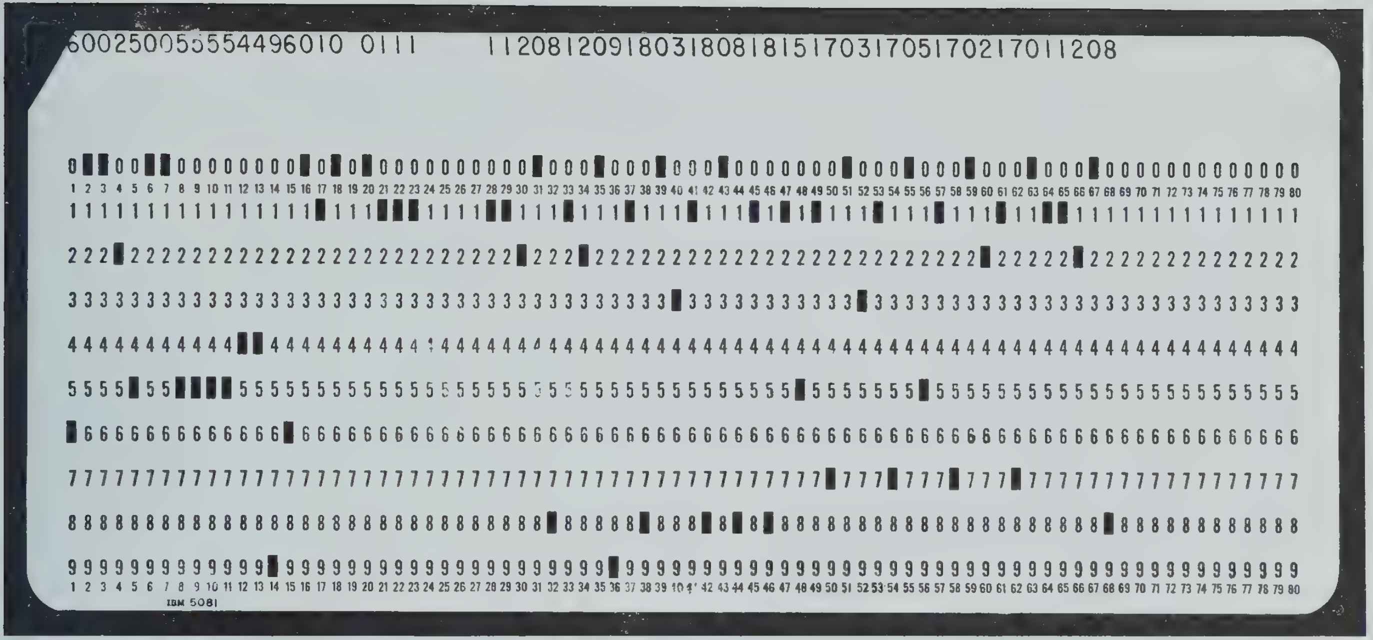
FIG. 6b

9. Using a blue ballpoint pen, measurement points were connected.
10. Using a red ballpoint pen, measurement points were numbered as a two digit number; example: 2=02, 9=09, 34=34, etc. Numbering started with 01 in the upper left corner of each sub-area progressing to the right and below. The last (highest) number in each sub-area was circled. This provided a check for the operator of the X-Y plotter.
11. Using a red lead pencil, all land use code areas were identified by code numbers.

Check procedures for data transfer.

1. Grid border corners and all DSA corners were checked to insure that measurement points existed and were numbered appropriately.
2. Land use boundaries were checked to be independent of municipality, census tract, and traffic zone boundaries.
3. All measurement points were numbered and connected.
4. All land use areas were labeled with pertinent code values.
5. Upon performing a detailed check of the overlay the control block was initialed appropriately for work accomplished.

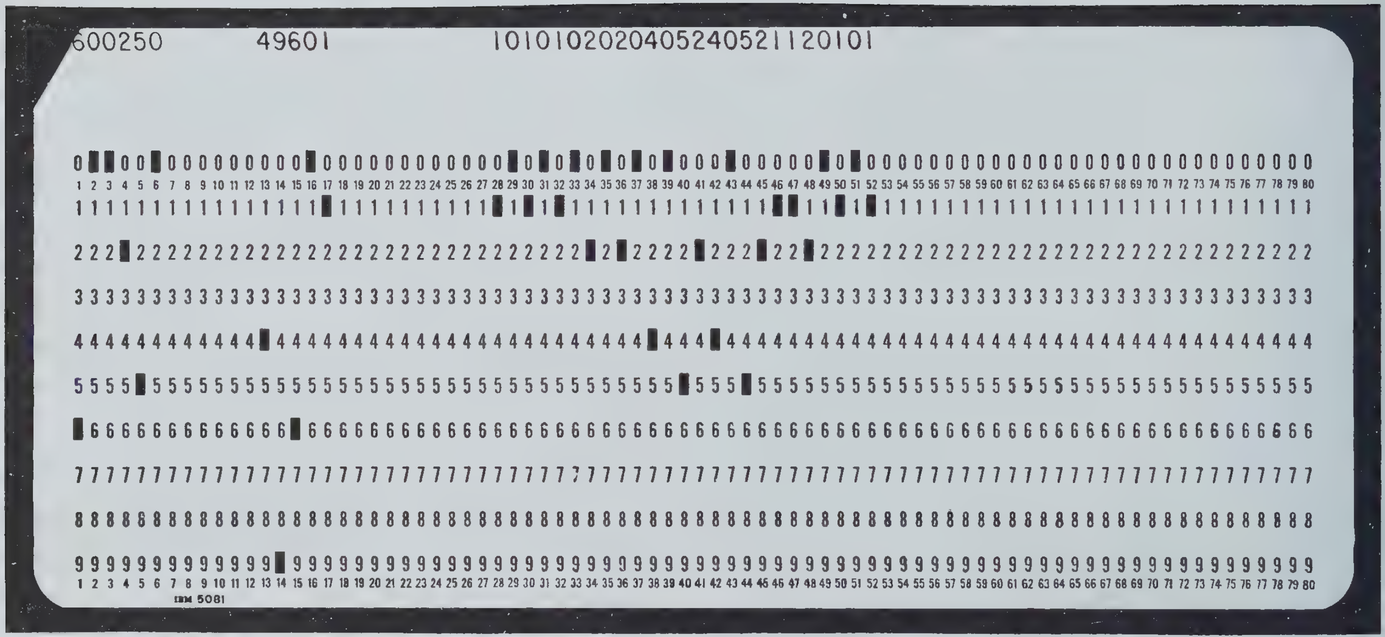
The overlays were then submitted to personnel who recorded the data according to card input procedures.



600250055554496010 0111 11208120918031808181517031705170217011208

IBM Card for Measurement Area Card describing the land use code 01, with 11 dwelling units. Refer to page 48 for column description

Fig. 7 a.



600250 49601 1010102020405240521120101

IBM Card for Traffic Zone Identification Deck
Traffic subzone 49601 in DSA 600 250

Fig. 7 b.

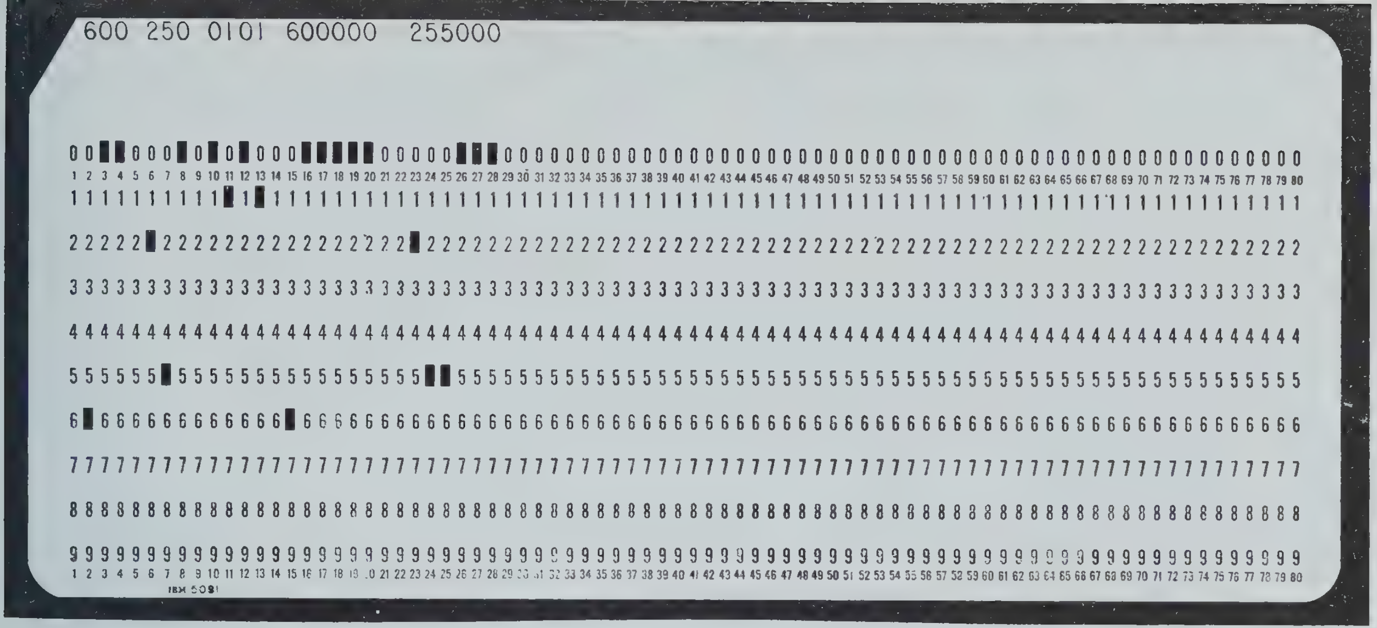
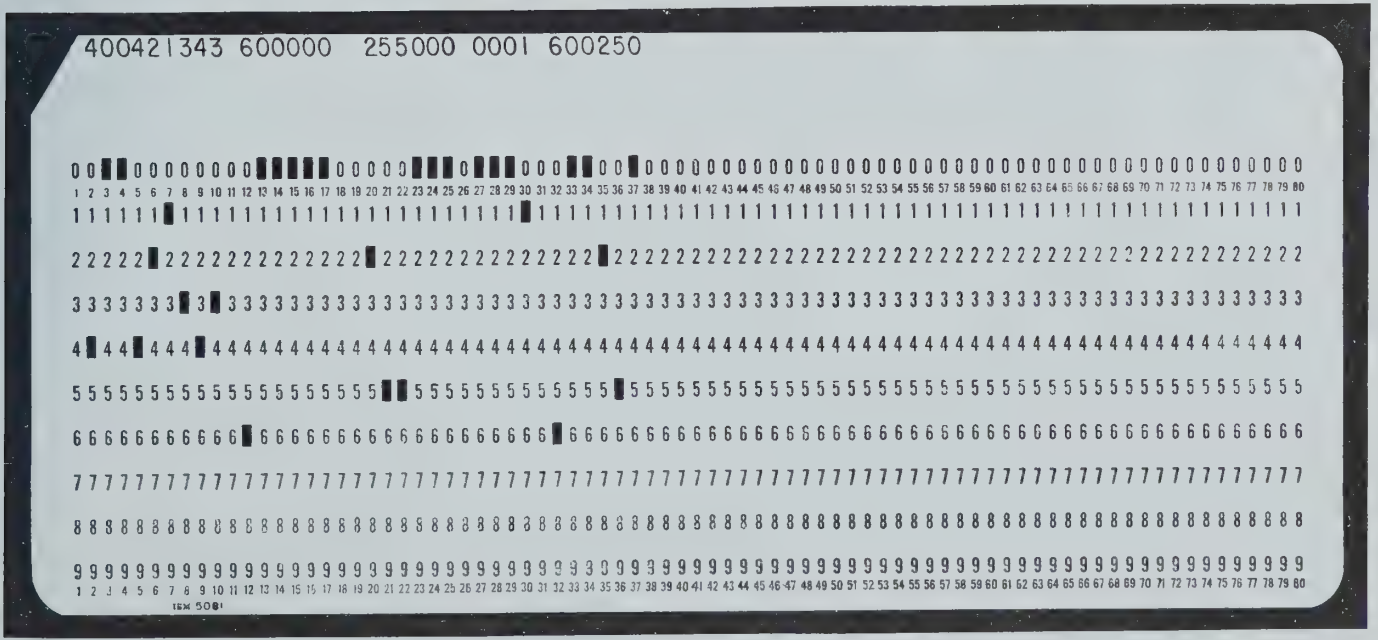


Fig. 7 c.

IBM Cards processed by ECARS Unit (see page 53.)
for: a. Point Identification Deck (above)
b. Vacant Land Identification Deck (below)

Fig. 7 d.



Transfer of Data from Overlays to Card Records. After the overlay was completed according to the steps enumerated above it was ready to be recorded onto cards. Two principal records were developed from the completed overlays. One is the Area Identification Deck (AID) and the other is the Point Identification Deck (PID). The procedures used to develop both will be described subsequently, however, prior to those steps, the need for clarity and accuracy on the overlays must be emphasized. The accuracy of the entire process is dependent on the quality of the overlays which become the basic source of all information. Illegible or poorly placed numbers induce confusion and errors. Extreme care was taken to insure that all data was recorded on the overlay properly. Where questionable numbers were observed during the recording phase they were returned, rechecked and modified as necessary before processing continued. However, even with this care considerable error was found during the computer data editing phase which indicates that additional checks could be incorporated into the process in future projects to insure more consistent data.

Both the Area Identification Deck and the Point Identification Deck were prepared using a fixed format. In the case of the AID records, all data required was recorded from the overlays by completing the Measurement and Recording Forms (see Fig. 8). The forms were completed in the following sequence for each measurement area. (The colors referred to are those used on the DSA overlay sheets to identify the subject item.)

. Form No.

DSA RDINATES		MUNICIPALITY	CENSUS TRACT	TRAFFIC ZONE	1952 DEV.	|	LAND USE		—	CARD NO.	MEASURE POINT		M.P.		M.P.		M.P.		M.P.		M.P.		M.P.		M.P.		M.P.		M.P.		M.P.		M.P.		M.P.	
	Y						CODE	DWELLING UNITS			SUB AREA	NUMBER	S.A.	NO.	S.A.	NO.	S.A.	NO	S.A.	NO.	S.A.	NO.	S.A.	NO.	S.A.	NO.	S.A.	NO.	S.A	NO.	S.A.	NO.	S.A.	NO.	S.A.	NO.
3	4 5 6	7 8 9	10 11 12	13 14 15 16 17	18	19	20 21	22 23	24 25 26 27	28	29 30	31 32	33 34	35 36	37 38	39 40	41 42	43 44	45 46	47 48	49 50	51 52	53 54	55 56	57 58	59 60	61 62	63 64	65 66	67 68	69 70	71 72	73 74	75 76	77 78	79 80

Fig. 8

1. Coordinate X and Y (Columns 1-3, 4-6) (Purple Numbers).

   Coordinate numbers indicate the DSA unit and area located at the lower left corner of each DSA. (The X coordinate numbers always exceed 500 and the Y coordinates are always less than 500). The last digit of the X and Y coordinates are either 0 or 5. Thus, columns 3 and 6 contained either 0 or 5.

2. Municipality Number (Columns 7-9) (Brown Number).

   Each municipality within the planning project had been identified numerically with a numeric code from 1-152. The proper numbers were recorded in the municipality field.

3. Census Tract Number (Columns 10-12) (Blue Number).

   There were 590 census tract numbers in the project area.

4. Traffic Zone - Subzone Number (Columns 13-17) (Orange Number).

   Columns 13-15 define the traffic zone number and columns 16-17, the subzone within the traffic zone. Complete five digit traffic subzone numbers were entered in the proper columns. A total of 626 traffic zones and 1801 traffic subzones were recorded.

5. Historic Land Use Development (Column 18) (Green Colored).

Areas developed after 1952 are referred to as newly developed areas. (See page 56.) These areas were defined on the overlays by green line boundaries and numbers. Land use code areas so defined have the digit "1" entered in column 18. Those areas not designated as newly developed areas have the digit "0" entered in column 18. Thus, only 1 or 0 numbers appear in column 18.

6. Land Use (Columns 20-23) (Red/Green Pencil Numbers).

Systematically starting with the land use measurement area in the top left corner of each DSA, each measurement area was recorded by its land use code. This two digit land use code appears in columns 20 and 21. When dwelling units exist in an area they were counted by an underscore of the land use code and appear below it on the overlay. This number was entered in columns 22 and 23. When no dwelling units exist in the land use measurement area, columns 22 and 23 have the digit "0" in each column.

7. Measurement Area Identification Points.

The measurement points are four digit numbers where the first two refer to the sub-area number (screenprinted black number centered in each sub-area of the overlay) and last two being the point number for each individual measurement point. Thus, to describe a particular land use measurement area columns 1-23 were recorded as explained previously; a "1" was entered in column 28 for the first card sequence and each land use measurement area was described by its measurement points returning to, and including, the original point for closure. When more than 13 such points were necessary to describe an area a "2" was entered in column 28 of the second card, the last measurement point recorded in columns 77-80 of the previous card was recorded in columns 29-32 and necessary measurement points were continued. The area had to be closed within nine cards or a maximum of 108 measurement points. However, this maximum total was never required. When two or more cards were completed the data recorded in columns 1 through 23 were automatically duplicated on all following sequence cards for that particular land use measurement area.

Utilizing the same Area Identification Deck format the traffic zones and subzones (see

Fig. 7b) were recorded by the numbers and measurement points describing each traffic area. This phase of data summary was termed the "Traffic Zone Conversion Index." Traffic zones and subzones were described by DSA, and recorded on the Measurement Area Card Format. However, the municipality, census tracts, historic development and land use code fields were not used. Areas outside the Boston Regional Planning boundary, but within a DSA, were assigned a traffic zone number of 99999 for recording and measuring.

The Point Identification Deck (see Fig. 7c) was prepared for each point used in the entire project area. The PID card records were prepared with an X-Y Coordinatograph (ECARS*) which is designed for fast, accurate conversion of graphic information into machine-sensible language. In operation, the overlay is placed on a drafting table on which the input coordinatograph is mounted. The scale and origin of X and Y coordinates of the overlay are set on the dials of the console. The operator moves the cursor over a selected measurement point and closes a foot pedal switch to automatically record X and Y coordinates and all required identifying codes on a punched card. Thus the resulting IBM punch cards become the information source constituting

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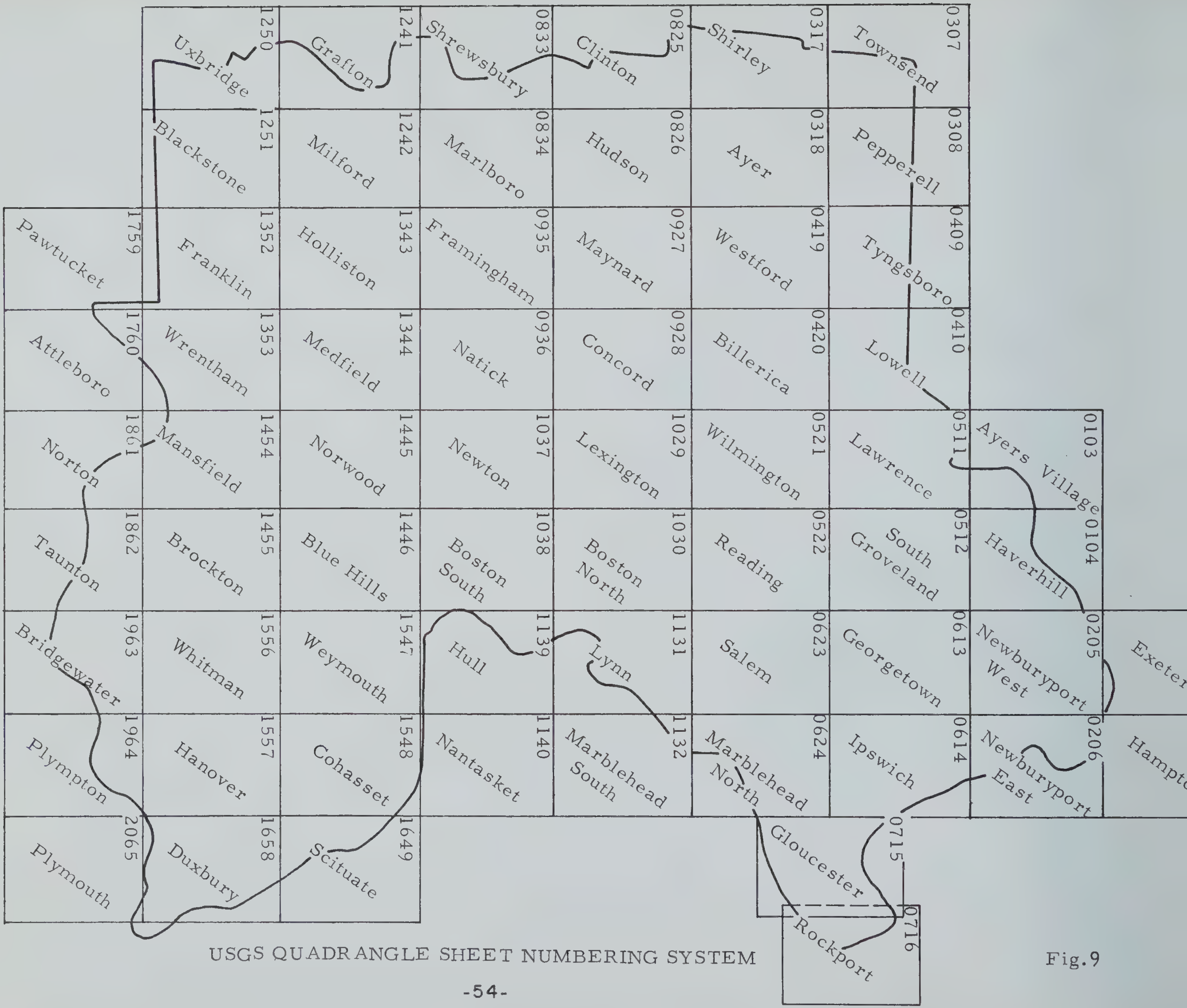
*ECARS is manufactured for Keuffel and Esser by Electronic Associates, Inc. of Long Branch, New Jersey.



USGS QUADRANGLE SHEET NUMBERING SYSTEM

Fig.9

the point identification deck. The card format for the PID is as follows:

Col. 2-4	DSAX of the DSA in which the measurement point is located.
Col. 6-8	DSAY of the DSA in which the measurement point is located.
Col. 10-13	Measurement Point Number
Col. 15-20	X Coordinate of the measurement point.
Col. 23-28	Y Coordinate of the measurement point.

The X-Y Coordinatograph was also used to produce the characteristic area data records described in Section IV which follows using the format described therein and shown on Fig. 7d.

Each of the card record types described in this section were placed on magnetic tape after they were produced by using an IBM 1401 computer for the card to tape conversion.

C. Land Use Inventory Summaries. The computations and summaries required for the project were prepared with a series of computer programs prepared for the CDC 3600 Computer. Summaries are described and listed in the Final Report. A complete document which describes the electronic data processing procedures for this project is available and should be consulted regarding detailed processing of the collected information. The reader is referred to that document for all detailed discussion and instructions concerning the processing of the data for the project.

SECTION IV.

ANALYTICAL STUDIES

A. Historic Land Development. By direct viewing of aerial photos from the United States Department of Agriculture photography taken in 1952 and photography taken in 1963 analysts annotated images on the 1963 prints indicative of changes in land use in the years between 1952 and 1963. A bright green pencil was used in noting the particular images where changes of land use occurred. The completed photos were then given to individuals performing the transfer of data from the photo enlargements (see page 40). The particular land use images indicated on the contact prints from the historic land development study were visually matched with the same images on the photo enlargements. These land use areas were then delineated and labeled with proper codes by bright green pencil on the overlays. These areas portraying recent land use development were described and recorded with the other land use measurement data. Summarization of the historic land development is contained in the Final Report.

B. Vacant Land Analysis. Four physical features (groundwater, topography, soils and bedrock) were considered significant in the effect on the status of potential land development. It was desirable and necessary to ascertain how these features occur with the 91 (forest, woodland, etc.) and 92 (vacant land, agricultural, nursery, etc.) land use codes established by the land use survey for an effective evaluation of the development potential of all vacant land.*

The following four physical characteristics were interpreted and described:

1. Surface drainage (groundwater)

    a. No problem
    b. Seasonally high groundwater table
    c. Perennially high groundwater table including swamps

2. Topographic characteristics

    a. Slopes less than 12%
    b. Slopes greater than 12%

3. Soil characteristics in terms of their development potential

    a. Excellent
    b. Suitable
    c. Poor

4. Depth to bedrock

    a. Deep
    b. Medium
    c. Shallow

---

*While the procedure was developed to define the development potential of vacant land (codes 91 and 92) it should be noted that all measurement areas could be identified with the four physical characteristics. This complete identification provides considerable additional flexibility for analyses of land development characteristics in the Boston Region.

Blue line copies of photomosaics and USGS base maps (scale 1" = 2000') were used as a base for grided acetate overlays upon which were established soil and bedrock characteristics. Each area was delineated and labeled on a set of contact prints (scale 1:18,000) as follows: Soils, E = excellent, S = suitable and P = poor; Bedrock, S = shallow, M = medium and D = deep.

The USGS quadrangle sheets (scale 1" = 2000') were used as a base for the topography, DSA grids were established on acetate overlays and accompanied each quad sheet. Where topography indicated a 12% or more slope gradient these areas were so delineated.

Groundwater information was established on one set of photomosaics (scale 1" = 2000'). This information was transferred to acetate overlays. Three sub-divisions were indicated: 1 = no problem; 2 = seasonally high groundwater table, and 3 = perennially high groundwater table including swamps.

Note: The areas on each overlay that have been so delineated according to the above discussion for the vacant land categories were sequentially numbered for the particular overlay. The sequential numbering was established with number 1 area for each sheet and therefore was not a continuous sequence from sheet to sheet.

IBM CARD Columns 1 - 80 (See Fig. 7d)

Card Input Explanation

Column 2 CODE

The four major categories and sub-divisions were numbered on the input data overlays as follows:

Category	Sub-division	Source Designation	IBM Card Designation	Master Summary Type Designation*
Groundwater	No problem	1	1	1 in Column 36
	Seasonally high groundwater table	2	2	2 in Column 36
	Perennially high groundwater	3	3	3 in Column 36
Topography	Slope less than 12%	Not indicated	Not indicated	
	Slope greater than 12%	Shown by areas	4	1 in Column 37
Soils	Excellent	E	5	1 in Column 38
	Suitable	S	6	2 in Column 38
	Poor	P	7	3 in Column 38
Bedrock	Deep	D	8	1 in Column 39
	Medium	M	9	2 in Column 39
	Shallow	S	0	3 in Column 39

*The Master Summary Type (MS7) is described fully in the Data Processing Procedure Manual. Column Designation refers to the column in the MS7 Logical Record.

Any one of the digits shown in the IBM Card Designator column appear in Column 2 of the IBM card. In comparing the vacant land information to land use area codes 91 and 92, the objective is to determine that areas designated 91 and 92 on the DSA overlays are either suitable or unsuitable for development with respect to the four physical characteristics considered significant.

Columns 3, 4, 5, 6 AREA NUMBER

Each delineated area regarding the above features was sequentially numbered per overlay.

Columns 7, 8, 9, 10 OVERLAY SHEET NUMBER

Four digit numbers were used to refer to each mosaic or quad overlay as assigned by B. R. P. P. (see Fig. 9 for the numbering system of the USGS Quadrangle Index).

Columns 12, 13, 14, 15, 16, 17 and 20, 21, 22, 23, 24, 25 X-Y COORDINATES

The scale of the photomosaics and quad sheets is 1'' = 2000' whereas the scale of the DSA overlays for the land use inventory is 1'' = 150' and 1'' = 300'. Due to the sensitivity of the ECARS unit, it was desirable to read each point to the nearest ten feet and maintain a zero terminal digit for the coordinate value. By automatically recording a zero in columns 17 and 25 (last digit of the X and Y coordinate respectively) a psuedo-scale was established of 1'' = 200' rather than 1'' = 2000' for input source information of vacant land analysis. At this scale each overlay sheet could be plotted by the ECARS unit without shifting the sheet numerous times. The point of origin for the scaling reference pertaining to mosaic and quad overlays was the lower left corner DSA point. The grids were oriented so that full DSA's were on one overlay.

Columns 27, 28, 29 and 30 SEQUENCE NUMBER

Each point within a particular area number had coordinate values recorded and numbered sequentially. It was the task of the computer to ascertain the areas and physical characteristics so indicated by the vacant land analysis input card. This requires merging the Vacant Land Analysis Identification Deck (VLAID) with the Area Identification Deck (AID) and Point Identification Deck (PID). Upon completion of this comparison, data in the Final Report indicates how all the measurement areas, particularly the 91 and 92 land use areas, occur with regard to the vacant land analysis features. Thus, the output data in the Final Report delineates all land use areas from the overlay source and also classifies all 91 and 92 land use codes from the land use survey. This should prove a significant tool in evaluating and forecasting the future development of the regional planning area.

SECTION V

MASTER CONTROL LISTS

In order to maintain control and to prevent loss of documents, a series of "Master Lists" were prepared. These lists were as follows:

A. Land Use Code Master List. A listing of numerical and alphabetical land use codes used in the Boston Regional Planning Project was made. There are sixty-three codes. These are described in Section IIB, page 16, entitled Land Use Code System. The Land Use Code Master List was duplicated and used for control, reference and checking purposes.

B. Data Summary Area Master Diagram. A diagram was prepared of all DSA's in the Boston Regional Planning Project. The diagram provided a master list of all DSA's within the study area for summary and checking purposes. A count was made of the exact number of DSA's (2881) to be utilized in data processing for the land use study.

C. Traffic Zone Master List. A listing was accomplished by DSA which showed the traffic zone(s) and/or subzone(s) within each DSA. A total of 626 traffic zones and 1801 traffic subzones were involved. This list was key-punched and verified and used for the measurement and recording control and checking purposes. This information is referred to as the Traffic Zone Identification Deck (TZID). Each traffic zone-subzone boundary was described by the subarea and measurement points on the overlay for photo enlargements. Area computations of traffic zones - subzones on a DSA basis were utilized to check land use measurement areas grouped by traffic zone.

D. Master Control List. The list referred to as the Master Control List was established on a DSA basis. Each DSA was listed and all traffic zone(s), census tract(s) municipality(ies) which appeared in the DSA were recorded. The Master Control List served as an overall data assembly check. The data contained was checked with appropriate data (municipality, census tract and traffic zone-subzone) indicated on the land use overlays. As the Master Control List and the overlay data was obtained from the common source of data for municipalities, census tracts and traffic zones-subzones, a further check was for use for the transfer of data to the overlays by comparison of the two data sources.

SECTION VI

CONTROL AUDIT AND ACCURACY CHECK

Objectives: In performing an extensive land use study it is necessary to control the progress made on a daily basis and to know exactly what was accomplished on a DSA basis. Each supervisor provided a DSA check list of work performed by the recorders. These lists were set up for the following procedures:

A. Photo Interpretation. A group leader assigned a DSA with the completed geographic coding to a photo interpreter and recorded the date the DSA was assigned and the name of the interpreter in the control space on the margin of the aerial photograph. A record was kept by the photo interpretation group leader. A copy was sent to the supervisor. The record indicated the following:

1. Date assigned to photo interpretation group leader
2. Name of photo interpretation group leader
3. Date assigned to photo interpreter
4. Name of photo interpreter
5. Date returned from photo interpreter
6. Date edited and checked by group leader
7. Result of checking

B. Field Data Coding. A field data coding group leader assigned a DSA with the completed geographic coding to a field data coder and recorded the date the DSA was assigned and the name of the field data coder was placed in the control space on the margin of the aerial photograph. A record was kept by the field data coding group leader. A copy was sent to the supervisor. This record included the following:

1. Date assigned to data coding group leader
2. Name of data coding group leader
3. Areas: photo interpreted, surveyed by automobile, surveyed on foot
4. Date assigned to data coder
5. Date returned from data coder
6. Name of data coder
7. Date edited and checked by group leader

C. Measurement and Recording. A measurement and recording group leader assigned a DSA with the completed land use coding and grid system accompanied by a pre-printed grid overlay. The date and initials of the recorder were placed in the control block in the lower left corner of the overlay upon completion of the overlay procedure. A record was kept in the form of a Status Sheet by the measurement and recording supervisor. This sheet represents the following:

1. Date of work performed on DSA with coordinates
2. Name of recorder
3. Rural or Urban photo enlargement
4. Amount of coverage per DSA (pertinent to where DSA is on border of project area)
5. Daily status of overlay(s) worked
6. Recorder's daily time and number of overlays worked on

Additonally, records were maintained as the overlay progressed through the various stages of the measurement and recording procedure. These records were kept for:

1. Land use and data transfer from photo enlargement to the overlay
2. Indication of historical development study
3. Traffic zone identification description (TZID)
4. Measurement Area Card (MAC) preparation for description of land uses, with accompanying traffic zone(s), census tract(s) and municipality(ies) by DSA
5. Key-punch and verification of data processed through MAC and TZID

D. Completing and Checking MAC Format by Supervisor. A supervisor thoroughly checked each MAC to make sure that each land use had been completed. Each line was read, edited and checked for omissions and incomplete information. If necessary, the form was returned for correction or completion. It necessitated a particular check to see that:

1. X-Y coordinate number was correct
2. Traffic zone was correct
3. Census code was correct
4. Municipality was correct
5. Initial and terminal measurement points were same and first measurement point of following card (where necessary) were same as the last point of the previous card.

E. Computer Editing. In reading the cards onto tape the IBM 1401 would not accept off-punch cards or cards with more than one punch per column. These cards were "dumped" and not read onto tape. The non-valid entries were corrected. After the preliminary editing of the 1401, each program utilized in the comprehensive land use study maintained an edit procedure. Prior to the operation of each program the computer sorted all data by DSA sequence and then edited for basic factors of accuracy.

All point identification cards (measurement point coordinates) were edited for valid coordinates corresponding to the DSA value and data entries related to the proper format.

All measurement area cards were edited for possible municipality, census tract and traffic zone-subzone data (e. g., as 152 municipalities are involved in the project a card showing municipality values such as 153 or greater were not acceptable). In the land use area description the original four digit point identification number was checked with the final number. For closure procedure these points were required to be identical. Additionally, the last four digit number of a preceding card (columns 77-80) and the first four digit number of a following card (columns 29-32) were required to be identical when describing a land use area or traffic zone that utilized more than one description card.

Computations for traffic zone areas were checked with land use area descriptions grouped by traffic zones for area and numerical checks within each DSA; thus, computations on a DSA basis (±5% of 573.92 acres) were additionally checked for internal summations.

F. Accuracy. Incorporated into the overall programming were several edit procedures to eliminate sources of possible error before any data was admitted to the computer. Through careful and selected use of equipment and manpower these edit programs virtually eliminated errors. This resulted in an overall 98% accuracy of the data after it was interpreted.

APPENDIX

A. Numerical Land Use Codes

B. Alphabetical Land Use Codes

C. Land Use Codes

  - Standard Industrial Classification
  - Boston Regional Planning Project
  - Bureau of Public Roads

D. Overlay Symbols

APPENDIX A

LAND USE CODES - NUMERICAL

SERIES	00	RESIDENTIAL	
	01	ONE FAMILY DWELLING (1 or 2 Trailers)	Dwelling Units Counted*
	02	TWO FAMILY	
	03	MULTIPLE DWELLING (3 or More Units)	
	05	BOARDING HOUSE, DORMITORY	
	06	HOTEL, MOTEL, TOURIST HOME, TOURIST CAMP	
	08	TRAILER COURT, TRAILER PARK (3 or More Trailers)	
	09	VACANT RESIDENTIAL BUILDING, ALL TYPES	

* The dwelling unit count is recorded under the land use code and the latter is underscored (i. e., $\frac{03}{67}$ 03 = multiple dwelling 67 = 67 dwelling units)

SERIES	10	DURABLE MANUFACTURING
	11	FURNITURE, LUMBER, OTHER DURABLE GOODS: MANUFACTURING
	14	METALS & ALLIED FABRICATING: MANUFACTURING
	15	MACHINERY, TRANSPORTATION EQUIPMENT: MANUFACTURING (Except Electrical Machinery)
	16	SCIENTIFIC & PROFESSIONAL INSTRUMENTS ELECTRICAL MACHINERY: MANUFACTURING
SERIES	20	NON-DURABLE MANUFACTURING
	21	FOOD, ALLIED PRODUCTS: MANUFACTURING
	22	TEXTILES, APPAREL, ALLIED PRODUCTS: MANUFACTURING
	23	CHEMICALS, PETROLEUM, PLASTICS, RUBBER, ALLIED PRODUCTS: MANUFACTURING
	24	PAPER, ALLIED PRODUCTS: MANUFACTURING
	25	PRINTING, ALLIED INDUSTRIES
	28	LEATHER, LEATHER PRODUCTS: MANUFACTURING
	29	VACANT MANUFACTURING BUILDING - ALL TYPES OF MANUFACTURING

SERIES	30	TRANSPORTATION, COMMUNICATION, PUBLIC UTILITIES QUARRIES
	31	RAILROAD FACILITIES DEPOT, REPAIR SHOP, RoW, YARDS
	32	BUS TAXI MOTOR PASSENGERS, TERMINAL, DEPOT, GARAGE
	33	AIRPORT FACILITIES (non-Military)
	34	TRUCK TRANSPORTATION MOTOR FREIGHT TERMINAL, DEPOT, GARAGE
	35	DOCK, PORT FACILITIES (Non-Military)
	36	MINE, QUARRY, SAND & GRAVEL PIT
	37	UTILITIES, COMMUNICATIONS ELECTRIC, GAS, SANITARY SERVICES PLANT SUB-STATION, VALVE STATION POWER LINE, GAS LINE, RoW RADIO, TV ANTENNA TELEGRAPH-TELEPHONE FACILITIES
	39	VACANT TRANSPORTATION, COMMUNICATION, PUBLIC UTILITY BUILDING

SERIES	40	RETAIL ESTABLISHMENTS
	41	FOOD, SUPERMARKET, DRUG STORE, HARDWARE: RETAIL
	42	MIXED RETAIL, SERVICES & RESIDENTIAL (Either 1 Story Mixed Retail and Services or 2 Story Building Mixed Retail, Services with 2nd Floor Residential)
	43	EATING AND DRINKING PLACES
	44	GENERAL RETAIL: DRY GOODS CLOTHING, APPAREL, ACCESSORIES: RETAIL DEPARTMENT STORE, FURNITURE, APPLIANCES: RETAIL
	45	MIXED RETAIL, SERVICES & RESIDENTIAL (1 Story Mixed Retail and Services Either 2, 3 or 4 Floors of Residential above) Note: If there are 5 or more Floors of Residential, it is coded 03.
	46	LUMBER, BUILDING MATERIALS, FEED: RETAIL
	47	GASOLINE SERVICE STATION
	48	AUTOMOTIVE DEALER: FARM & HEAVY EQUIPMENT: RETAIL MARINE EQUIPMENT: TRAILER SALES: RETAIL (Including Automobile Repair & Parts)
	49	VACANT RETAIL BUILDING

SERIES	50	WHOLESALING, WAREHOUSING, STORAGE
	55	INTENSIVE WHOLESALE, STORAGE (ENCLOSED): ALLIED PRODUCTS, APPLIANCE, AUTOMOTIVE, DRY GOODS, ELECTRICAL, FOOD, HARDWARE, STORAGE
	56	EXTENSIVE WHOLESALE, STORAGE (OPEN-YARDS): AUTO SALVAGE, BUILDING MATERIALS, CHEMICALS, LUMBER, PETROLEUM (GAS-OIL), WRECKING YARD
	59	VACANT WHOLESALE, WAREHOUSE, STORAGE BUILDING
SERIES	60	SERVICES: PERSONAL, OFFICE, FINANCE
	61	PERSONAL SERVICES: BARBER-BEAUTY SHOPS, CLEANING & DYEING COLLECTION, SHOE SHINE
	64	OFFICE BUILDINGS: BUSINESS SERVICES, DENTAL SERVICES, ELECTRONICS: RESEARCH AND DEVELOPMENT, LEGAL AND PROFESSIONAL SERVICES, MEDICAL SERVICES, OFFICES AND OFFICE BUILDINGS (Not Classified Elsewhere) (Does Not Include Transportation, Communication and Utilities). REPAIR SERVICES (Except Automotive Repair) WHOLESALE SERVICES (Without Stock)
	65	FINANCE, INSURANCE, REAL ESTATE SERVICES: BANKING SERVICES, SAVINGS AND LOAN OFFICE FINANCE AND INSURANCE CORPORATION SERVICES, INSURANCE AND REAL ESTATE BROKERS SERVICES.

	67	PARKING* (Over 2,000 sq. ft.) RESTRICTED OR PRIVATE
	68	PARKING** (Over 2,000 sq. ft.) PUBLIC
	69	VACANT OFFICE BUILDINGS
SERIES	70	PUBLIC, QUASI-PUBLIC BUILDINGS
	71	HOSPITAL: CLINIC INSTITUTIONAL HOME NURSING HOME OLD PEOPLE'S HOME, REST HOME ORPHANAGE
	72	INDOOR RECREATION, ENTERTAINMENT: ATHLETIC CLUB, GYMNASIUM BOWLING ALLEY CLUBS, LODGES, FRATERNITIES, SORORITIES INDOOR SWIMMING POOL SKATING RINK, INDOOR THEATRE MOVIE HOUSE, NIGHT CLUB YMCA, YWCA
	73	CULTURAL, RELIGIOUS: ART GALLERY, MUSEUM ASSEMBLY HALL CHURCH GROUNDS

* Parking, greater than 2,000 square feet, is coded 67: Restricted or Private Parking where the parking is restricted to one land use, such as private parking for factory employees, or restricted parking for an office building, or restricted parking for a university and used exclusively by the faculty.

** Parking, greater than 2,000 square feet, is coded 68: Public Parking where parking is a service to more than one establishment and/or operated as an independent parking lot, such as a commercial parking garage or parking lot, a parking area serving a supermarket or shopping center.

	74	SCHOOLS: PUBLIC, PAROCHIAL, NURSERY, PRIMARY & SECONDARY
	75	UNIVERSITIES: COLLEGES, HIGHER & ADULT EDUCATION
	76	MILITARY INSTALLATIONS (National Guard Included)
	77	GOVERNMENT BUILDINGS CITY HALL, COUNTY OFFICE FIRE HALL, GOVERNMENT OFFICE POLICE STATION (Not Military Installation)
	78	POST OFFICE
	79	VACANT PUBLIC & QUASI-PUBLIC BUILDING
SERIES	80	PUBLIC OPEN SPACE, OUTDOOR RECREATION
	83	MAJOR PARKS AND OUTDOOR RECREATION FACILITIES BOTANICAL GARDEN, ZOO, GAME RESERVE, CEMETERY PARK: MUNICIPAL, STATE, NATIONAL FOREST: STATE, NATIONAL
	85	AMUSEMENT FACILITIES: OUTDOOR AMUSEMENT PARK, FAIRGROUND, TOT LOT ATHLETIC FIELD, BALL PARK, TENNIS COURT BEACH*, SWIMMING, SKATING, OUTDOOR GOLF COURSE, GOLF DRIVING RANGE, MINIATURE GOLF
	86	RACE TRACK, STADIUM, DRIVE-IN THEATRE

* See Following Page

SERIES	90	VACANT LAND (99 is Major Code)
	91	FOREST LAND, WOODLAND (Not State, National Forest, Not Orchard)
	92	AGRICULTURAL USES AND VACANT LOTS: BEACH*, CROPS, DAIRY FARM, GRASSLAND, GREENHOUSE, LIVESTOCK (ALL FARM ANIMALS), NURSERY, OPEN LAND (VACANT LOTS), ORCHARD, PASTURE, VINEYARDS
	93	SWAMP (FLOODLAND, MARSH)
	94	WATER (LAKE, RESERVOIR, RIVER, CANAL)
	97	RESIDENTIAL CONSTRUCTION PROJECT (Count and record dwelling units under construction)
	98	CONSTRUCTION PROJECT: ALL NON-RESIDENTIAL TYPES
	99	ROADS, (RoW): (Major Only) ALLEY, HIGHWAY, LANE, STREET

* Definition of Beach Codes:

1. Beaches where land along the shore/coast line is utilized for commercial and/or public use is coded 85.
2. Beaches where land along the shore/coast line is private or not in utilization (vacant) is coded 92.

APPENDIX B

LAND USE CODES - ALPHABETICAL

CODE	
92	AGRICULTURAL USES, VACANT LAND: CROPS, DAIRY FARM, GRASSLAND, PASTURE, GREENHOUSE, NURSERY, LIVESTOCK (ALL FARM ANIMALS), ORCHARD, VACANT LAND (CULTIVATED AND UNCULTIVATED), VINEYARDS
41	AGRICULTURAL PRODUCE: RETAIL
14	AIR CONDITIONING, EQUIPMENT: FABRICATION
15	AIRCRAFT, AUTOMOBILES AND PARTS: MANUFACTURING
33	AIRPORT (NON-MILITARY)
99	ALLEY
32	AMBULANCE FACILITY
85	AMUSEMENT PARK
64	ANIMAL HOSPITAL, VETERINARIAN
73	ART GALLERY
23	ASPHALT: MANUFACTURING
73	ASSEMBLY HALL
72	ATHLETIC CLUB
85	ATHLETIC FIELD, AMUSEMENT PARK, BALL PARK, OUTDOOR AMUSEMENT
48	AUTO SALES, OUTDOOR LOT, SHOWROOM: RETAIL, AUTO PARTS AND REPAIR
56	AUTO SALVAGE, WRECKING YARD, JUNK DEALER
44	AUCTIONEER

CODE	
21	BAKERY: MANUFACTURING
41	BAKERY: RETAIL
85	BALL PARK
65	BANK, TRUST COMPANY, SAVINGS & LOAN OFFICE
61	BARBER, BEAUTY SHOP
43	BAR, NIGHT CLUB
	BARN (Mark Out With "X" and Do Not Code)
92	BEACH: PRIVATE OR OPEN LAND
85	BEACH: RECREATIONAL USES COMMERCIAL AND/OR PUBLIC
61	BEAUTY SHOP
21	BEVERAGE: BOTTLING
64	BICYCLE: RETAIL & REPAIR
05	BOARDING HOUSE, ROOMING HOUSE, DORMITORY
44	BOOK SHOP
55	BOTTLED GAS, AIR REDUCTION PRODUCTS: STORAGE
15	BOILER SHOP
72	BOWLING ALLEY
46	BUILDING MATERIALS: RETAIL
56	BUILDING EQUIPMENT, MATERIAL: STORAGE, WHOLESALE
*	BUILDING, VACANT (Coded To Appropriate Major Use)
09	VACANT RESIDENTIAL BUILDING
29	VACANT MANUFACTURING BUILDING
39	VACANT TRANSPORTATION, COMMUNICATION, PUBLIC UTILITY BUILDING
49	VACANT RETAIL BUILDING
59	VACANT WAREHOUSE, STORAGE BUILDING
69	VACANT OFFICE BUILDING
79	VACANT PUBLIC, QUASI-PUBLIC BUILDING
32	BUS, TAXI: TERMINAL, DEPOT, GARAGE
64	BUSINESS MACHINES, OFFICE EQUIPMENT: SALES, SERVICE

CODE	
95	CANAL
21	CANDY: MANUFACTURING
55	CANDY: DISTRIBUTION, WHOLESALE, WAREHOUSE
41	CANDY: RETAIL
22	CANVAS GOODS: MANUFACTURING
11	CEMENT PRODUCTS: MANUFACTURING
83	CEMETERY
23	CHEMICALS & ALLIED PRODUCTS: MANUFACTURING
73	CHURCH SUNDAY SCHOOL
61	CLEANING, DYEING, LAUNDRY: COLLECTION SHOPS
23	CLEANING, DYEING, LAUNDRY: PROCESSING PLANT
71	CLINIC
44	CLOTHING: RETAIL
22	CLOTHING: MANUFACTURING
72	CLUB LODGE
75	COLLEGE, UNIVERSITY, ADULT EDUCATION (Students Over 18 Years Old)
55	COLD STORAGE
64	COIN MACHINE SERVICE
72	COMMERCIAL INDOOR RECREATION, ENTERTAINMENT
11	CONCRETE, TRANSIT MIXED
97	CONSTRUCTION PROJECT: RESIDENTIAL
98	CONSTRUCTION PROJECT: ALL NONRESIDENTIAL TYPES
56	CONTRACTOR'S STORAGE & YARD
23	CREOSOTE TREATMENT
44	CROCKERY: RETAIL
44	CURIO, GIFT SHOP
21	DAIRY PRODUCTS: MANUFACTURING
41	DAIRY PRODUCTS: RETAIL
64	DENTAL SERVICES
44	DEPARTMENT STORE

CODE	
44	DISCOUNT HOUSE
35	DOCK FACILITIES
05	DORMITORY
44	DRESSMAKER, TAILOR
43	DRIVE-IN RESTAURANT
86	DRIVE-IN THEATRE
85	DRIVING RANGE, GOLF
41	DRUGS: RETAIL
44	DRY GOODS: RETAIL
56	DUMP
61	DYEING: COLLECTION, DISTRIBUTION
23	DYEING: PROCESSING PLANT
44	ELECTRICAL APPLIANCES: RETAIL
55	ELECTRICAL EQUIPMENT, APPLIANCE: WHOLESALE, STORAGE
16	ELECTRICAL EQUIPMENT, APPLIANCES, MACHINERY: MANUFACTURING
64	ELECTRICAL REPAIR SHOP
64	ELECTRONICS: RESEARCH, DEVELOPMENT, TESTING LABS
23	EXPLOSIVE: MANUFACTURING & STORAGE
64	EXTERMINATING SERVICE
48	FARM EQUIPMENT: RETAIL
01	FARM HOUSE
85	FAIRGROUND
46	FEED: RETAIL
23	FERTILIZER: MANUFACTURING
65	FINANCE COMPANY OFFICE
46	FLOOR MATERIAL: RETAIL
44	FLORIST
21	FOOD: MANUFACTURING
55	FOOD, CANDY, LIQUOR; DISTRIBUTION, WHOLESALE, WAREHOUSE

CODE	
41	FOOD: RETAIL
91	FOREST, WOODLAND (Not Orchard 92)
72	FRATERNITY, LODGE, CLUB, SORORITY
11	FURNITURE: MANUFACTURING
44	FURNITURE: RETAIL
64	FURNITURE: REPAIR
44	FURS: RETAIL
83	GAME RESERVE
32	GARAGES: BUS, TAXI
34	GARAGES: FREIGHT
68	GARAGES: PUBLIC PARKING, OVER 10,000 SQUARE FEET
37	GAS, PLANT, SUB-STATION, VALVE STATION, RoW
47	GASOLINE STATION
44	GENERAL BUSINESS, MISCELLANEOUS
	AUCTIONEER, BOOKSELLER, GIFT SHOP
	DISCOUNT HOUSE, KEY SHOP
	NEWS, MAGAZINE STAND, NOTIONS
	NOVELTIES, OPTICAL SALES
	PET SHOP, SURPLUS STORE
44	GLASS SALES, INSTALLATION: RETAIL
85	GOLF COURSE, DRIVING RANGE, MINIATURE GOLF
77	GOVERNMENT BUILDINGS & LAND (Except Post Office 78) (Not Parks, Forest or Military)
55	GRAIN STORAGE
36	GRAVEL, SAND PITS: PROCESSING, STORAGE
64	GUNSMITH, GUN REPAIRS
72	GYMNASIUM

CODE	
55	HARDWARE, HOUSEWARE: WHOLESALE, STORAGE
41	HARDWARE, HOUSEWARE: RETAIL
44	HAT SHOP: RETAIL
46	HEATING, VENTILATING, PLUMBING, EQUIPMENT: RETAIL
28	HIDES, TALLOW, LEATHER TANNING: MANUFACTURING
99	HIGHWAY, EXPRESSWAY, ROAD
06	HOTEL, MOTEL, TOURIST HOME, TOURIST CAMP
48	HOTEL EQUIPMENT: RETAIL
71	HOSPITAL, CLINIC, INSTITUTIONAL HOME
41	ICE: RETAIL
21	ICE: MANUFACTURING
21	ICE CREAM: MANUFACTURING
72	INSTITUTIONAL USES (Not Elsewhere Described)
11	INTERIOR DECORATION: WORKSHOP
64	INTERIOR DECORATION: SERVICE
95	IRRIGATION FACILITY, CANAL, RESERVOIR
44	JEWELER: RETAIL
55	JOBBER, BULK SALES
64	JOBBER, WHOLESALE SERVICE (Without Stock)
56	JUNK DEALER
64	KENNELS
64	KEY SHOP
64	LABORATORY: ANALYTICAL CHEMICAL
99	LANE
61	LAUNDRY, SELF-SERVICE: COLLECTION, DISTRIBUTION
23	LAUNDRY: PROCESSING PLANT
64	LEGAL OFFICE, LAWYER
28	LEATHER, TANNING

CODE	
64	LINEN SUPPLY SERVICE
55	LIQUOR: DISTRIBUTION, WHOLESALE, WAREHOUSE
41	LIQUOR: RETAIL
21	LIVESTOCK, POULTRY: SLAUGHTERING, MEAT PACKING
72	LODGE, CLUB, FRATERNITY, SORORITY
11	LUMBER, SAWMILL
46	LUMBER, BUILDING MATERIAL: RETAIL
56	LUMBER: STORAGE, WHOLESALE
15	MACHINE SHOP
48	MACHINE EQUIPMENT: RETAIL, DISPLAY, RENTAL
48	MARINE EQUIPMENT: RETAIL
93	MARSH
22	MATTRESS: MANUFACTURING
41	MEAT, FISH: RETAIL
55	MEAT, FISH: STORAGE, WHOLESALE
71	MEDICAL CLINIC
64	MEDICAL, DENTAL OFFICE
14	METALS, HEAVY & LIGHT OPERATIONS, SHEET METAL
14	METAL DOORS, WINDOWS: MANUFACTURING
14	METALS: PRIMARY MANUFACTURING
76	MILITARY INSTALLATION, BASES, NATIONAL GUARD
36	MINE
11	MONUMENT: MANUFACTURING
61	MORTUARY
06	MOTEL, HOTEL, TOURIST HOME, TOURIST CAMP
48	MOTORCYCLE, REPAIR
34	MOTOR FREIGHT TERMINAL: DEPOT, GARAGE, WAREHOUSE
73	MUSEUM, ART GALLERY
75	MUSIC INSTRUCTION SCHOOL
44	MUSIC STORE: RETAIL

CODE	
83	NATIONAL FOREST, NATIONAL PARK
16	NEON SIGNS, FABRICATION, INSTALLATION
25	NEWSPAPER PRINTING
44	NEWS, MAGAZINE STAND
72	NIGHT CLUB
44	NOTIONS, NOVELTY SHOP
05	NURSES' HOME, DORMITORY
64	OFFICE EQUIPMENT: SALES & SERVICE
64	OFFICES, OFFICE BUILDINGS (Not Classified Elsewhere) (Except Transport, 34: Communication & Utility, 37)
64	OFFICE SERVICE: MIMEOGRAPHING, STENOGRAPHY, BLUE PRINTING
64	OFFICE: MEDICAL, DENTAL
23	OIL REFINING: MANUFACTURING
56	OIL, PETROLEUM, GASOLINE, FUEL: STORAGE, WHOLESALE
71	OLD PEOPLE'S HOME, REST HOME
64	OPTICIAN, OPTOMETRIST
16	OPTICAL GOODS: MANUFACTURING
44	OPTICAL: RETAIL
71	ORPHANAGE, PRIVATE INSTITUTION
23	PAINT: MANUFACTURING
46	PAINT: RETAIL
83	PARK MAJOR
85	PARK: AMUSEMENT
68	PARKING LOT, PUBLIC GARAGE (Over 10,000 sq. ft.)
*	PARKING LOT (Attach to Business, Under 10,000 sq. ft.)
44	PAWN SHOP
44	PET SHOP
23	PETROLEUM, ALLIED PRODUCTS: MANUFACTURING

CODE	
44	PHOTO SUPPLIES: RETAIL
64	PHOTO, COMMERCIAL STUDIO
56	PLUMBING: WHOLESALE, STORAGE
46	PLUMBING, EQUIPMENT: RETAIL
37	PIPE LINE, GAS, OIL, RoW
37	POWER LINE, MAJOR RoW
37	POWER PLANT, POWER SUB-STATION
25	PRINTER
36	QUARRY, MINE
86	RACE TRACK
37	RADIO, TV, BROADCASTING STATION, STUDIO, ANTENNA MAST(S)
31	RAILROAD, ALL FACILITIES, DEPOT, WAREHOUSE, REPAIR SHOP
64	REPAIR SHOP: TV, RADIO, ELECTRICAL, FURNITURE, GUNSMITH (Except Automobile, Motor Cycle)
64	REPRODUCTION SERVICE, BLUE PRINTING, MIMEOGRAPHING
64	RESEARCH DEVELOPMENT AND TESTING LAB
	RESIDENCES:
01	SINGLE FAMILY DWELLING
02	TWO FAMILY DWELLING, DUPLEX, SEMI-DETACHED
03	MULTIPLE DWELLING (3 or More Units)
05	BOARDING HOUSE, ROOMING HOUSE, DORMITORY
06	MOTEL, HOTEL, TOURIST HOME
08	TRAILER PARK, TRAILER COURT (Not Trailer Sales)
09	VACANT RESIDENTIAL BUILDING
71	REST HOME
43	RESTAURANT, DRIVE-IN RESTAURANT
43	ROADSIDE STAND, FOOD, DRINK: RETAIL

CODE	
41	ROADSIDE STAND, FOOD, AGRICULTURAL PRODUCE: RETAIL
05	ROOMING HOUSE, DORMITORY
23	RUBBER STAMP: MANUFACTURING
36	SAND PIT
65	SAVINGS & LOAN OFFICE
74	SCHOOL, NURSERY (Students Under 18 Years)
75	SCHOOL, BUSINESS COLLEGE (Students Over 18 Years) ART, BARBER, BEAUTY, BUSINESS DANCING, DRIVING, MUSIC
44	SECONDHAND STORE
47	SERVICE STATION, GASOLINE
42	SERVICES & RETAIL MIXED (With or Without 1 Story Residential Over)
45	SERVICES & RETAIL MIXED WITH 2, 3, or 4 FLOORS OF RESIDENTIAL OVER
	SHACK (Mark Out With "X")
14	SHEET METAL WORK, FABRICATION, INSTALLATION
61	SHOE REPAIR
44	SHOES: RETAIL
64	SIGN SHOP (NON-ELECTRICAL)
72	SKATING RINK: INDOOR
85	SKATING RINK: OUTDOOR
72	SORORITY, FRATERNITY, CLUB, LODGE (Not College or University)
44	SPORTING GOODS: RETAIL
86	STADIUM
83	STATE FOREST, PARK
64	STENOGRAPHY SERVICE
99	STREET
93	SWAMP, MARSH, FLOODLANDS
72	SWIMMING POOL: INDOOR, PRIVATE, COMMERCIAL
85	SWIMMING POOL: OUTDOORS

CODE	
44	TAILOR: CUSTOM
32	TAXIS: GARAGE, STAND
37	TELEPHONE-TELEGRAPH FACILITY
37	TELEVISION, BROADCASTING STATION, STUDIO, ANTENNA MAST(S)
64	TV REPAIR SHOP
85	TENNIS COURT
72	THEATER, MOVIE HOUSE
86	THEATER: DRIVE-IN
48	TIRE REPAIR: EQUIPMENT
32	TRANSPORTATION TERMINAL: MOTOR PASSENGER, DEPOT, GARAGE
34	TRANSPORTATION TERMINAL: MOTOR FREIGHT, DEPOT, GARAGE
15	TRANSPORTATION EQUIPMENT: MANUFACTURING
48	TRAILER SALES
08	TRAILER COURT
64	TRAVEL BUREAU
65	TRUST COMPANY
11	UPHOLSTERER
61	UNDERTAKER
44	VARIETY STORE: RETAIL
15	VENTILATING EQUIPMENT: FABRICATION
44	VENTILATING EQUIPMENT: RETAIL
*	VACANT BUILDING (Coded to Appropriate Use)
09	VACANT RESIDENTIAL BUILDING
29	VACANT INDUSTRIAL BUILDING
39	VACANT TRANSPORTATION, COMMUNICATION, PUBLIC UTILITY BUILDING
49	VACANT RETAIL BUILDING
59	VACANT WAREHOUSE, STORAGE BUILDING
69	VACANT OFFICE BUILDING
79	VACANT PUBLIC, QUASI-PUBLIC BUILDING

CODE	
92	VACANT LAND: AGRICULTURAL, UNCULTIVATED LAND
94	WATER, INCLUDES RIVER, FLOOD CONTROL AREA, LAKE, IRRIGATION CANAL, RESERVOIR
93	MARSH SWAMP
21	WATER, BEVERAGE BOTTLING
23	WATER SOFTENING
11	WOOD DOORS: MANUFACTURING
11	WOODWORKING: CABINET, CUSTOM MILLWORK
55	WAREHOUSE, WHOLESALE HOUSE (ALL TYPES)
14	WELDING SHOP
56	WRECKING YARD
72	YMCA, YWCA
83	ZOO

APPENDIX C

STANDARD INDUSTRIAL CLASSIFICATION
BOSTON REGIONAL PLANNING PROJECT
BUREAU PUBLIC ROADS

S.I.C. CATEGORIES	B.P.R. CODES	B.R.P.P. CODES	
			(A) AGRICULTURE, FORESTRY, FISHERIES:
01	90	92	COMMERCIAL FARMS
02	90	92	NON-COMMERCIAL FARMS
07	90	92	AGRICULTURAL SERVICES, HUNTING, TRAPPING
08	91	91	FORESTRY
09	92. 95	94	FISHERIES
			(B) MINING:
10	36	36	METAL MINING
11	36	36	ANTHRACITE MINING
12	36	36	BITUMINOUS COAL LIGNITE MINING
13	36	36	CRUDE PETROLEUM, NATURAL GAS
14	36	36	MINING, QUARRYING, NON-METALLIC MINERALS (NOT FUELS)

S.I.C. CATEGORIES	B.P.R. CODES	B.R.P.P. CODES	
			(C) CONTRACT CONSTRUCTION:
15	37	57	BUILDING CONSTRUCTION: GENERAL CONTRACTORS
16	37	56	CONSTRUCTION (NOT BUILDINGS), GENERAL CONTRACTORS
17	37	56	CONSTRUCTION, SPECIAL TRADE CONTRACTS
		97	RESIDENTIAL HOUSING CONSTRUCTION
		98	HIGHWAY CONSTRUCTION
			(D) MANUFACTURING:
19	34	15	ORDINANCE, ACCESSORIES
20	18	21	FOOD, KINDRED PRODUCTS
21	27	21	TOBACCO MANUFACTURERS
22	19	22	TEXTILE MILL PRODUCTS, ETC.
23	20	22	APPAREL, FINISHED PRODUCTS MADE FROM FABRICS
24	10	11	LUMBER, WOOD PRODUCTS, EXCEPT FURNITURE
25	11	11	FURNITURE, FIXTURES

S.I.C. CATEGORIES	B.P.R. CODES	B.R.P.P. CODES	
			(D) MANUFACTURING: (Continued)
26	24	24	PAPER, ALLIED PRODUCTS
27	21	25	PRINTING, PUBLISHING, ALLIED INDUSTRIES
28	22	23	CHEMICALS, ALLIED PRODUCTS
29	23	23	PETROLEUM REFINING, RELATED INDUSTRIES
30	26	23	RUBBER, MISCELLANEOUS PLASTIC PRODUCTS
31	28	28	LEATHER, LEATHER PRODUCTS
32	11	11	STONE, CLAY, GLASS PRODUCTS
33	13	14	PRIMARY METAL INDUSTRIES
34	14	14	FABRICATED METAL PRODUCTS (EXCEPT ORDINANCE, MACHINERY, TRANSPORTATION EQUIPMENT)
35	15	15	MACHINERY, EXCEPT ELECTRICAL
36	16	16	ELECTRICAL MACHINERY, EQUIPMENT SUPPLIES
37	25	15	TRANSPORTATION EQUIPMENT
38	17	16	PROFESSIONAL, SCIENTIFIC, CONTROLLING INSTRUMENTS: PHOTOGRAPHIC, OPTICAL GOODS: WATCHES, CLOCKS

S.I.C. CATEGORIES	B.P.R. CODES	B.R.P.P. CODES	
			(D) MANUFACTURING: (Continued)
39	29	39	MISCELLANEOUS MANUFACTURING INDUSTRIES
			(E) TRANSPORTATION, COMMUNICATION, PUBLIC SERVICES:
40	30. 31	31	RAILROAD TRANSPORTATION
41	32	32	LOCAL, SUBURBAN, INTER-URBAN, PASSENGER TRANSPORTATION
42	34	34	MOTOR FREIGHT TRANSPORTATION, WAREHOUSING
44	35	35	WATER TRANSPORTATION
45	33	33	AIR TRANSPORTATION
46	35	37	PIPE LINE TRANSPORTATION
47	35	--	TRANSPORTATION SERVICES
48	38	37	COMMUNICATION
49	39	37	ELECTRIC, GAS, SANITARY SERVICES

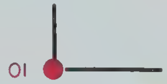
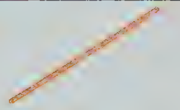
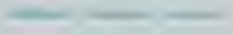
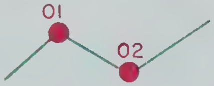
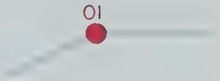
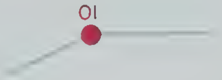
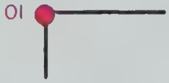
S.I.C. CATEGORIES	B.R.P. CODES	B.R.P.P. CODES	
			(F) WHOLESALE TRADE AND RETAIL TRADE:
50	53 - 57	55, 56	WHOLESALE TRADE
52	48, 50, 51	46, 48	RETAIL TRADE: BUILDING MATERIALS, FARM EQUIPMENT
53	45	44	RETAIL TRADE: GENERAL MERCHANDISE
54	40, 41	41	RETAIL TRADE: FOOD, DRUGS, HARDWARE
55	48, 49	47, 48	AUTOMOTIVE DEALERS, GASOLINE SERVICE STATIONS
56	46	44	RETAIL TRADE: APPAREL, ACCESSORIES
57	47	44	RETAIL TRADE: FURNITURE, HOME FURNISHINGS, EQUIPMENT
58	43	43	RETAIL TRADE: EATING, DRINKING PLACES
59	45	44	RETAIL TRADE: MISCELLANEOUS RETAIL STORES
			(G) FINANCE, INSURANCE, REAL ESTATE:
60	65	65	BANKING
61	65	65	CREDIT AGENCIES (OTHER THAN BANKS)

S.I.C. CATEGORIES	B.P.R. CODES	B.R.P.P. CODES	
			(G) FINANCE, INSURANCE, REAL ESTATE: (Continued)
62	65	65	SECURITY, COMMODITY BROKERS, DEALERS, EXCHANGE SERVICES
63	65	65	INSURANCE CARRIERS
64	65	65	INSURANCE AGENTS, BROKERS, SERVICE
65	65	65	REAL ESTATE
66	65	65	COMBINATION OF REAL ESTATE, INSURANCE, LOANS, LAW OFFICES
67	65	65	HOLDING, OTHER INVESTMENT COMPANIES
			(H) SERVICES:
70	60	61	PERSONAL SERVICES
73	68	64	MISCELLANEOUS BUSINESS SERVICES
75	63	48	AUTOMOBILE REPAIR, AUTOMOBILE SERVICES, GARAGES
76	64	64	MISCELLANEOUS REPAIR SERVICES
78	81	72	MOTION PICTURES

S.I.C. CATEGORIES	B.P.R. CODES	B.R.P.P. CODES	
			(H) SERVICES: (Continued)
79	81	72	AMUSEMENT, RECREATION SERVICES, EXCEPT MOTION PICTURES
80	66	64	MEDICAL, OTHER HEALTH SERVICES
81	67	64	LEGAL SERVICES
82	70	75	EDUCATIONAL SERVICES
84	73	73, 78	MUSEUMS, ART GALLERIES, BOTANICAL, ZOOLOGICAL GARDENS
86	74 - 76	73	NON-PROFIT MEMBERSHIP ORGANIZATIONS
			(I) GOVERNMENT:
91	77	77, 78	FEDERAL GOVERNMENT
92	78, 79	77	STATE GOVERNMENT
93	78, 79	77	LOCAL GOVERNMENT
94	78, 79	77	INTERNATIONAL GOVERNMENT

APPENDIX D

OVERLAY SYMBOLS

AREA DESCRIPTION	COLOR DESCRIPTION	NUMERICAL CODE	BOUNDARY SYMBOL
Data Summary Area	Purple Felt Marker	695	
Traffic Subzone	Orange Felt Marker	18703	
Census Tract	Blue Felt Marker	598	
1952 Development	Bright Green Pencil		
Town Number and Boundary	Brown Felt Marker	123	XXXXX
Measurement Area Points	Red Lead Pencil	01	
Measurement Area Boundaries	Blue Ballpoint Pen		
Measurement Area Point Nos.	Red Ballpoint Pen	01	
Land Use Code Nos.	Red Lead Pencil	94	
Data Summary Area Corners	Red Lead Pencil		

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